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# Finding Invention

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# FINDING INVENTION

OSKAR LIIVAK\*

## ABSTRACT

*One of the biggest problems plaguing modern patent law is its inability to provide predictable and clear exclusive rights. We would improve clarity by simply following the patent statute and extending exclusion only to “the patented invention.” That suggestion, as reasonable as it may sound, is actually quite radical to the dominant patent law orthodoxy. It is not even clear under the dominant patent law orthodoxy what it would mean to limit patent scope to the invention, but it is generally presumed that it must lead to unacceptably narrow patents. Thus, even if it provides clarity, the invention is thought to be just too narrow a concept to provide enough protection for inventors.*

*This Article takes up that worry and shows that the invention is actually broader than many think. While still providing predictable and clear patent boundaries, it can provide much of the protection that many incorrectly fear would be lacking in an invention-based patent system. Interestingly, this Article does not need to create this theory of the invention anew. It already exists; we just need to find it. For the first 100 years of U.S. patent law, the invention was the focal point of most cases. Those early cases provide a much-needed seed stock from which to redevelop an understanding of the invention. What emerges from that historical exploration is a concept with deep precedential support and surprisingly sophisticated internal structure that can tackle our current challenge of providing both clear and adequate protection to inventors. Surprisingly, the invention tethers patent scope to the patent disclosure while still explaining the wide range of patent scope decisions and even allowing scope to extend to after-arising technology in predictable ways.*

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## I. INTRODUCTION

Patent law's grand challenge is to grant patents that promote the "progress of science and useful arts."<sup>1</sup> That means both providing adequate protection for inventors and administering that protection efficiently. There is a growing consensus that modern patent law has failed at this challenge.<sup>2</sup> In their book, *Patent Failure*, Michael Meurer and James Bessen reach exactly this worrisome conclusion. In diagnosing this grim condition, Meurer and Bessen lay blame on the patent system's inability to provide clear public notice of patent boundaries.<sup>3</sup> They argue that the doctrines that determine patent scope are "unpredictable."<sup>4</sup> Patent scope has become what the Supreme Court long ago feared: "a nose of wax which may be turned and twisted in any direction."<sup>5</sup> Meurer and Bessen note that today, "[t]here is thus no reliable way of determining patent boundaries short of litigation. . . ."<sup>6</sup> The crux of their argument focuses on the significant costs associated with these ill-defined patent boundaries.<sup>7</sup> They conclude that, "the main goal of [patent] reform should be to improve patent notice."<sup>8</sup>

In recent work, I identified a critical conceptual misstep that has contributed to this public notice failure.<sup>9</sup> Modern patent law has mistakenly allowed patent claims to be seen as direct delineations of a patent's boundaries rather than as linguistic tools for "pointing out and distinctly claiming the subject matter which the applicant regards as his invention."<sup>10</sup> In other words, we have lost sight of the invention—the substantive technical solution created by the inventor. That misstep has, to a large extent, caused the "fuzzy boundaries" lamented by Meurer and Bessen.<sup>11</sup> Claim drafting has become a

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1. U.S. CONST. art. I, § 8, cl. 8.

2. See JAMES BESSEN & MICHAEL J. MEURER, *PATENT FAILURE: HOW JUDGES, BUREAUCRATS, AND LAWYERS PUT INNOVATORS AT RISK* 10 (2008); DAN L. BURK & MARK A. LEMLEY, *THE PATENT CRISIS AND HOW THE COURTS CAN SOLVE IT* (2009); see also FED. TRADE COMM'N, *TO PROMOTE INNOVATION: THE PROPER BALANCE OF COMPETITION AND PATENT LAW AND POLICY* ch. 5, at 1-10 (2003), available at <http://www.ftc.gov/os/2003/10/innovationrpt.pdf>.

3. BESSEN & MEURER, *supra* note 2, at 10.

4. *Id.*

5. *White v. Dunbar*, 119 U.S. 47, 51 (1886).

6. BESSEN & MEURER, *supra* note 2, at 10.

7. See *id.* at 25-26.

8. *Id.* at 236.

9. See Oskar Liivak, *Rescuing the Invention from the Cult of the Claim*, 42 SETON HALL L. REV. 1 (2012).

10. 35 U.S.C. § 112 (2006).

11. BESSEN & MEURER, *supra* note 2, at 10.

relatively unconstrained game of requesting valuable intellectual real estate rather than an exercise in concisely delineating the substantive invention. The invention, once understood as a substantive concept, can both constrain and define patent exclusion.<sup>12</sup>

Though a focus on the substantive, technical invention as a limit for patent exclusion surely has common sense appeal, many question whether the invention can shoulder the responsibility of defining both adequate and clear boundaries.<sup>13</sup> Most notably, there is confusion over the exact content of the substantive invention.<sup>14</sup>

For some, the invention is a very narrow concept tied directly to the actual physical thing made by the inventor.<sup>15</sup> That narrow definition can provide well-defined boundaries, but many object, arguing that, though clear, it would provide far too narrow protection.<sup>16</sup> In particular, such a rule would prevent patent protection from reaching after-arising technology—a type of patent scope that, though controversial, has been available in some form for quite some time. For others, the invention is a broader concept encompassing some more abstract idea behind the actual thing created by the inventor. Though such broader protection could be adequate and indeed can easily reach after-arising technology, its more abstract nature makes it unlikely to be capable of well-defined, predictable boundaries.

Both of these two seemingly contradictory views appear in the courts.<sup>17</sup> Most important, the Supreme Court has, in some cases, described the invention narrowly, focusing on the thing built by the inventor, while at other times the Court has focused more on the abstract principles behind the thing built by the inventor.<sup>18</sup> Indeed, patent scope decisions by courts cover a huge range, varying from case to case in what appears to be an incoherent fashion. Patent law grants very broad patent scope in some instances, while in seemingly similar cases it grants little or no scope.<sup>19</sup>

With such confusion and apparent contradiction, the invention hardly appears to be a good vehicle for clearly defining patent boundaries.<sup>20</sup> Yet this Article argues that the invention is in fact a far more coherent, predictable concept than generally thought. It can provide

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12. See 35 U.S.C. § 271(a) (2006).

13. See *infra* notes 32-37 and accompanying text.

14. See Liivak, *supra* note 9, at 6-31.

15. See *infra* notes 34-76 and accompanying text.

16. See *infra* note 34 and accompanying text.

17. See *infra* notes 75-80 and accompanying text.

18. See *id.*

19. See BURK & LEMLEY, *supra* note 2, at 26-27.

20. Indeed, some have given up using it as workable definition of patent exclusion, while others go further and embrace the full range of possible definitions of the invention (and therefore exclusion) as a feature of the system, arguing that its inherent vagueness offers courts wide policy latitude to tailor patent scope. See Tun-Jen Chiang, *The Levels of Abstraction Problem in Patent Law*, 105 NW. U. L. REV. 1097 (2011).

much needed “predictability” while still granting “an appropriate reward.”<sup>21</sup> In a sense it possesses the clarity and concreteness of the narrow vision with breadth and protection afforded by the more abstract view. When properly understood, the invention can explain why some patentees receive a lot of scope and why some do not, including explaining the varying reach of patents into after-arising technology.

Interestingly, this Article does not need to create this concept of the invention afresh—it already exists. The notion of the invention presented here pervaded patent law throughout the nineteenth century. Well-known cases, such as *O'Reilly v. Morse*,<sup>22</sup> *Winans v. Denmead*,<sup>23</sup> *Tilghman v. Proctor*,<sup>24</sup> and the *Incandescent Lamp Bulb Patent* case,<sup>25</sup> are still cited today and taught as foundational patent law cases.<sup>26</sup> And though dealing with technologies that surely appear primitive, they articulated a vision of the invention that was anything but pedestrian. As developed there, the invention was not any one particular embodiment disclosed in the patent, nor was it a more abstract “idea” behind that embodiment. Instead, the invention was best understood as the *set* of embodiments disclosed in the patent. And, just as importantly, those cases also developed a sophisticated understanding of how embodiments could be disclosed. They showed how, *in some circumstances*, inventors could disclose (and thus claim) embodiments with clarity and specificity that would later use after-arising technology.<sup>27</sup> I describe this alternatively as a functional disclosure or a trans-technological disclosure.

The key to the internal structure of the invention is that they are not all the same. Akin to the spectrum of authorship in copyright that spans high and low authorship,<sup>28</sup> the invention in patent law spans broad and narrow inventorship.<sup>29</sup> Some inventors, for reasons discussed below, can and do invent (and disclose) a large number of

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21. BESSEN & MEURER, *supra* note 2, at 237.

22. 56 U.S. (15 How.) 62 (1854).

23. 56 U.S. (15 How.) 330 (1854).

24. 102 U.S. 707 (1881).

25. 159 U.S. 465 (1895), *aff'g* Consol. Elec. Light Co. v. McKeesport Light Co., 40 F. 21 (W.D. Pa. 1889).

26. See F. SCOTT KIEFF ET AL., *PRINCIPLES OF PATENT LAW* (5th ed. 2011); ROBERT PATRICK MERGES & JOHN FITZGERALD DUFFY, *PATENT LAW AND POLICY: CASES AND MATERIALS* (5th ed. 2011).

27. See *infra* notes 103-26 and accompanying text.

28. See Jane C. Ginsburg, *Creation and Commercial Value: Copyright Protection of Works of Information*, 90 COLUM. L. REV. 1865, 1870 (1990) (“We have now, as we have long had, two kinds of copyright: in high authorship works, such as novels and narrative histories, copyright protects the authorial presence within the work; in low authorship works, such as telephone directories and compilations of stock quotations, copyright protects the labor and resources invested in the work’s creation.”).

29. See Oskar Liivak, *Maintaining Competition in Copying: Narrowing the Scope of Gene Patents*, 41 U.C. DAVIS L. REV. 177 (2007) (describing an extreme case of narrow inventorship: the purification and isolation of naturally occurring gene sequences).

related embodiments. This is broad inventorship, and the inventor's patent can cover this relatively broad set of things. In contrast, some inventors cannot invent and disclose broadly. This is narrow inventorship, and having disclosed just one or a very limited number of embodiments, the scope of their patent cannot extend beyond that narrowly defined set. Patent scope is simply a function of the number and variety of embodiments invented and disclosed. When defined in this way, the invention is not only uniform and predictable, but also able to explain and predict a wide range of patent scope decisions.

In addition to explaining the variations in patent scope generally, the invention can also explain the varying reach of a patent scope into after-arising technology. An inventor who understands the inner workings of a particular embodiment can generalize other solutions that are variations on the particular embodiment. In describing these alternatives via specific yet functional language the disclosure can teach embodiments that will utilize after-arising technology. Such generalized, often functionally defined embodiments enable today's disclosures to teach future persons of skill to build embodiments using after-arising technology. Importantly, though styles of claiming have been examined in the literature, there has been far less examination of the necessarily earlier question of modes of disclosure. And though functional claiming is an emerging topic of academic interest,<sup>30</sup> this Article aims to address the topic of functional disclosure. Though critically important for reaching after-arising technology, such disclosures (and the broad patent scope they implicate) need to be closely regulated as they can, if not carefully reviewed, be easily abused.

The following Parts further examine these issues. Part II explores the contours of the invention and develops the historic understanding of the invention as the set of disclosed embodiments. The Part shows that a broad invention can be disclosed in two related ways. An inventor can explicitly disclose alternative embodiments by elaborating the structural details of these alternatives; this, of course, contributes to broad patent scope. In addition, the inventor can disclose what I describe as a generalized embodiment that, though not defined with the same explicit structural detail as some embodiments, is nonetheless still detailed enough for any person of skill, *without more*, to practice the invention. As will be shown, that later method of disclosure will be critical for understanding how patents can disclose embodiments today that only become a reality in the future. Those generalized embodiments and their functional disclosure allow patent scope to reach into after-arising technology.

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30. See, e.g., Mark A. Lemley, *Software Patents and the Return of Functional Claiming* (Stanford Pub. Law Working Paper No. 2117302, 2012), available at [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2117302](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2117302).

Part III explores the circumstances in which such broad protection is not available. The Part shows that though broad patent scope is available sometimes, it is not available for every invention or for every aspect of every invention. Some inventors may only disclose one embodiment and their patent will be similarly narrow. Relatedly, for some inventions, some features of the invention cannot be generalized. For some parts of the invention, the inventor cannot provide alternatives; some features are essential. For example, though a patentee might disclose a large array of materials for constructing embodiments of, say, a new tennis racket, she might disclose only one particular shape of the constituent parts. In that case, the invention is relatively broad as to material but quite narrow as to shape—it all depends on the embodiments disclosed.

Having outlined the general concept of narrow inventions, the Part proceeds to focus attention on one important such class of narrow inventions: found inventions. These are inventions that are created using trial-and-error techniques; many of the screening techniques in modern biotechnology are best seen as such trial-and-error techniques. When embodiments are found using these techniques, often inventors are quite limited in their ability to generalize other embodiments that will also work, and accordingly, such inventions are generally afforded only rather narrow claim scope. And that is entirely consistent with protecting the disclosed invention. In these areas, the invention is narrow. The Part applies these ideas to the controversial area of monoclonal antibody patents and concludes that the so called antibody exception is one clear example where today's patent system allows claims that improperly extend well beyond the actual invention disclosed.

Part IV takes this concept of both broad and narrow aspects of inventions and applies them to the knotty problem of after-arising technology. It shows that, contrary to conventional thinking, inventors can disclose embodiments today that will only be created tomorrow using after-arising technology. Disclosure of such embodiments depends on the careful use of functional language. The Part shows that the reach of patent scope into after-arising technology turns out to be just a variant of the broad inventorship described in Part II.

The bulk of the first four Parts of the Article focus on defining the content of the invention and showing that it, descriptively, can explain the varying landscape of patent scope decisions. Part V takes on the challenging task of addressing the normative arguments for limiting patent exclusion to the invention. It argues that such a limit reduces system costs by improving patent notice. Furthermore, it argues for the adequacy of the invention as a limit for patent scope.

## II. THE INVENTION AS THE SET OF DISCLOSED EMBODIMENTS

This Part explores the basic contours of the invention. Ultimately, it concludes that the invention should be viewed as the set of embodiments disclosed in the patent itself. To reach that understanding, the Part turns to patent history. By consulting a series of Supreme Court cases and treatises from the 1800s, this Part uncovers that era's sophisticated understanding of the invention as the set of disclosed embodiments. That history shows that this definition is broader than may be initially thought. In most cases, the invention is not limited to the exact thing physically built by the inventor. Generally, it is not even limited to any one particular embodiment disclosed in the patent. Instead, the concept of the invention developed during that time viewed the invention as the set of the disclosed embodiments. There are a number of benefits to this vision. First, by tethering the invention to things that are *disclosed*, patent law ensures the patent itself provides the objective evidence of the invention. This enables clarity and predictability. In addition, patent law allows embodiments to be disclosed not just by explicitly mentioning them. By allowing disclosure through a generalized embodiment that defines the "principle of the invention," the patentee can disclose a relatively broad set of embodiments, including embodiments that utilize after-arising technology. Third and lastly, by maintaining a focus on *embodiments* as the primitive unit of the invention, patent law tethers the invention to the concrete, tangible world of completed solutions that are ready to put into practice by "any person of skill." That avoids the need to plumb more abstract, vague, and likely difficult notions of the "ideas" inherent in a patent.

### A. Limiting Patent Scope to the Disclosed Invention: An Uphill Battle

Before laying out the case for limiting patent scope to the disclosed invention, it is worth noting that the conventional wisdom in patent law certainly does not consider the disclosed invention to be the limit of patent scope—notwithstanding the clear language of the statute.<sup>31</sup> For example, a recent article relayed this conventional wisdom when it stated:

[D]espite the black-letter rule that an inventor "can lawfully claim only what he has invented and described," courts and the Patent Office typically allow patent claims that are of much broader scope than what is actually disclosed in a patent application. Specifically, a patent will usually disclose just one or a few "embodiments" of

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31. See 35 U.S.C. § 271(a) (2006).



the invention in the patent's specification, but will often claim thousands of different embodiments in a claim.<sup>32</sup>

Others make similar statements, noting that "[c]laims are frequently a far cry from what the inventor invented"<sup>33</sup> and that the patent system "has always provided more in terms of patent scope than merely those embodiments expressly disclosed by the inventor in her application."<sup>34</sup>

Others add to this by rationalizing that the invention is just too narrow to provide enough protection. Lemley and Burk cite Judge Learned Hand as stating that "a claim that covers only the thing invented is a weak claim indeed."<sup>35</sup> And in their influential article on claim scope, Merges and Nelson add that:

At first blush it might seem to make sense to limit the rights of a patentee to only those embodiments of the invention she has disclosed in her specification, i.e., those that she has actually created at the time the patent application is filed. But imitators would soon find some minor variation over the disclosed embodiments . . . . Such a rule would soon render patents useless.<sup>36</sup>

One of the leading casebooks similarly chimes in that "[i]f courts strictly limit the scope of patent protection to the specific examples disclosed in the specification, competitors could readily circumvent the patent through minor changes in design."<sup>37</sup> Similarly, a recent article discussed fears that a "rule limiting patent claims to the em-

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32. Ted Sichelman, *Commercializing Patents*, 62 STAN. L. REV. 341, 356 (2010) (footnotes omitted) (quoting *O'Reilly v. Morse*, 56 U.S. (15 How.) 62, 121 (1854)).

33. Janice M. Mueller, *A Rich Legacy*, 14 BERKELEY TECH L.J. 895, 899 (1999) (quoting an email from Judge Giles Rich).

34. Janice M. Mueller, *The Evolving Application of the Written Description Requirement to Biotechnological Inventions*, 13 BERKELEY TECH. L.J. 615, 651 (1998).

35. BURK & LEMLEY, *supra* note 2, at 62. Judge Hand wrote:

If the claims were limited to the "concise and exact terms" in which the specifications ordinarily describe a single example of the invention, few, if any, patents, would have value, for there are generally many variants well-known to the art, which will at once suggest themselves as practicable substitutes for the specific details of the machine or process so disclosed. It is the office of the claims to cover these, and it is usually exceedingly difficult, and sometimes impossible, to do so except in language that is to some degree "functional"; for obviously it is impossible to enumerate all possible variants.

*Philip A. Hunt Co. v. Mallinckrodt Chem. Works*, 177 F.2d 583, 585 (2d Cir. 1949). In other words, Burk and Lemley were using the "thing invented" to refer only to the actual physical thing created by the inventor. See BURK & LEMLEY, *supra* note 2, at 62. As described below, the invention as used here (and as used in the patent statute) is much broader than this. In fact, Learned Hand, in the cited portion of *Philip A. Hunt Co. v. Mallinckrodt Chemical Works*, makes clear that the invention should be something along the lines argued for here. See 177 F.2d at 585. It should include alternatives and variants conceived and reduced to practice (often just constructively) by the inventor.

36. Robert P. Merges & Richard R. Nelson, *On the Complex Economics of Patent Scope*, 90 COLUM. L. REV. 839, 845 (1990).

37. MARTIN J. ADELMAN ET AL., CASES AND MATERIALS ON PATENT LAW 459 (2d ed. 2003).

bodiments taught by the specification . . . would eviscerate patent incentives.”<sup>38</sup> Even Chris Cotropia, who is otherwise one of the few people also pushing for recognition of a substantive notion of the invention, worries that “[p]rotection over, at most, the . . . invention may not be enough . . .”<sup>39</sup> Not to be outdone, the Court of Appeals for the Federal Circuit has made statements along these lines. For example, in *Gemstar-TV Guide International, Inc. v. International Trade Commission*, the Federal Circuit stated “[t]his court has expressly rejected the contention that if a patent describes only a single embodiment, the claims of the patent must be construed as being limited to that embodiment.”<sup>40</sup>

In short, arguing, as this Article does, that patent scope should not exceed the disclosed invention certainly appears to be an uphill battle. But some of the conflict may be due to loose usage of terminology. First, some may refer to the invention or the actual invention when they are instead referring to the actual, physical thing built by the inventors.<sup>41</sup> Ed Kitch, in his foundational article on the patent system, warned against making exactly that mistake.<sup>42</sup> As used here,

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38. Tun-Jen Chiang, *Defining Patent Scope by the Novelty of the Idea*, 89 WASH. U. L. REV. 1211, 1228 (2012) (“Confining the patentee to the specific embodiments in the specification would mean that a pirate could change a few nuts and bolts and thereby avoid infringement.”).

39. Christopher A. Cotropia, *What is the “Invention”?*, 53 WM. & MARY L. REV. 1855, 1911 (2012). Cotropia argues for use of what he calls the external notion of the invention as a limit for literal claim scope. *Id.* at 1910. This, he argues (and I agree), will generate procedural efficiency and clarity for claim interpretation. *See id.* at 1910-13. And where literal claim scope is not sufficient, Cotropia would rely on the doctrine of equivalents to add exclusive protection beyond the actual invention. *Id.* at 1911-13. As we rely more on the doctrine of equivalents, we will just be pushing the boundary uncertainty problem into that famously uncertain doctrine. *See id.* at 1912-13. I do not think that is advisable. All the clarity that is gained by relying on the actual invention is lost if ultimate claim scope depends on the doctrine of equivalents. To get *patent scope* certainty we need to also limit the doctrine of equivalents to the objective evidence in the patent itself.

40. 383 F.3d 1352, 1366 (Fed. Cir. 2004) (quoting *Liebel-Flarsheim Co. v. Medrad, Inc.*, 358 F.3d 898, 906 (Fed. Cir. 2004)) (internal quotation marks omitted); *see also* *Phillips v. AWH Corp.*, 415 F.3d 1303, 1323 (Fed. Cir. 2005) (en banc); *Gemstar-TV Guide*, 383 F.3d at 1366 (“Our precedent has emphasized that the disclosure in the written description of a single embodiment does not limit the claimed invention to the features described in the disclosed embodiment.”).

41. *See* cases cited *supra* note 40.

42. Edmund W. Kitch, *The Nature and Function of the Patent System*, 20 J.L. & ECON. 265, 268 (1977) (“[T]he ‘hornbook’ rule is very misleading—the inventor may not claim more than he has invented, and the claim marks the outer bounds of his rights. We tend to think of an invention as the thing an inventor has made or accomplished, and the rule seems to imply the inventor is confined to that. But the rule is misleading, because the invention as claimed in the patent claims and the physical embodiment of the invention are two quite different things. ‘A claim is an abstraction and generalization of an indefinitely large number of concrete, physical objects.’ Thus to illustrate from a nineteenth-century case, an inventor could claim a process of separating fats into glycerine and stearic, margaric and oleic acids through the use of heat, pressure, and water at any temperature and in any apparatus that would work.” (footnotes omitted) (quoting PETER D.

particular examples (whether actually reduced to practice or constructively reduced to practice in the specification) will be referred to as embodiments, while the complete set of those disclosed embodiments will be generally referred to as the disclosed invention. Second, another misconception that may be fueling the above fears is the idea that a patent specification discloses only one embodiment.<sup>43</sup> This is just not the case. As will be discussed in more detail below, patent specifications routinely can contain many, sometimes infinite, variations and alternative embodiments. Third, some may also mistakenly think that a specification discloses a small number of embodiments because they forgot or ignore that the patent specification also contains the original claims.<sup>44</sup> As made clear by the text of the disclosure statute,<sup>45</sup> claim language is part of the specification, and as a result, it discloses (or at least helps disclose) a large number of embodiments.<sup>46</sup>

Nonetheless, even when these misconceptions and loose terminology are accounted for, there still remains unease over limiting patent scope to the disclosed embodiments. First, there are worries that copyists can too easily steal the heart of the invention while evading the patent scope with minor alterations.<sup>47</sup> Second, there are more specific worries that such a limit will foreclose certain types of patent scope.<sup>48</sup> For example, some are concerned that such a rule will also prevent the related ability of patents that reach into after-arising technology.<sup>49</sup> A central assumption of these worries is that, as noted above by Merges and Nelson, the “embodiments . . . disclosed in [a] specification” are limited to “those that [were] actually created at the time the

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ROSENBERG, PATENT LAW FUNDAMENTALS 39 (1975)) (citing *Tilghman v. Proctor*, 102 U.S. 707 (1880))).

43. See Tun-Jen Chiang, *The Levels of Abstraction Problem in Patent Law*, 105 NW. U. L. REV. 1097 (2011).

44. See *id.*

45. See 35 U.S.C. § 112 (2006).

46. See Brief for Oskar Liivak as Amicus Curiae Supporting Defendant-Appellant at 12, *Ariad Pharms., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336 (Fed. Cir. 2010) (No. 2008-1248), 2009 WL 4616152.

47. See *supra* notes 35-36 and accompanying text.

48. Christopher A. Cotropia, *“After-Arising” Technologies and Tailoring Patent Scope*, 61 N.Y.U. ANN. SUR. AM. L. 151, 165 (“[C]laims technically cannot capture the later-developed technologies because to do so would require the claims to be interpreted as they are understood at some time after the filing date. In fact, the quintessential example of an enforceable equivalent, after-arising technology, would always be unclaimable new matter for the patent as filed.” (quoting *Glaxo Wellcome, Inc. v. Impax Labs., Inc.*, 356 F.3d 1348, 1354 (Fed. Cir. 2004))).

49. See also Chiang, *supra* note 38, at 1237 (“But Liivak does not explain how his rule would avoid the pitfall of this approach, which is that later improvements cannot be taught at the time of the patentee’s initial conception, but at least some such later improvements (e.g., substituting plastic for wood) should be covered.”).

patent application is filed.”<sup>50</sup> That assumption inherently forecloses the reach of disclosed embodiments into after-arising technology.<sup>51</sup>

As explored in much greater depth below, patent law has developed an understanding of the invention and the set of disclosed embodiments that can, and in fact do, what many have assumed is not possible. The concept of the invention explored below shows that inventors can disclose well-defined embodiments today that will only be built tomorrow with after-arising technologies. Understanding how that can be done is central to understanding the proper reach of the *disclosed* invention into after-arising technology.

### *B. The Invention as the Inventor’s Completed Solution*

The invention, as used here and as used in the patent statute, does not include assumptions about the novelty or obviousness of the thing created by the inventor. In other words, inventors often invent solutions that turn out to be old or obvious. These are still inventions, but importantly, they are not *patentable* inventions.<sup>52</sup> In short, patent scope is the result of two determinations: first, what was invented, and second, what part of that invention is patentable? Though largely ignored today, that framework has been part of patent law for at least the past 150 years.<sup>53</sup>

The invention in patent law is the inventor’s own specific solution to some pressing problem (independent of its novelty or nonobviousness). Importantly, that means that though it is correct to say that this Article argues that the disclosed invention forms an upper limit for patent scope, it should be emphasized that not every inventor necessarily receives patent scope that reaches that limit because parts of his or her invention may well turn out to be old or obvious.

As used here, the invention “is the particular means devised by the inventor by which [a] result is attained . . . .”<sup>54</sup> In other words, the invention is the *solution* to a problem. The problem itself and the de-

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50. Merges & Nelson, *supra* note 36, at 845.

51. Many look to the doctrine of equivalents for allowing patent scope to capture after-arising technology. *See supra* note 39.

52. This point—separating the invention from the novelty and obviousness of that invention—needs to be emphasized, because by the middle of the twentieth century, patent law was using invention in two confusing ways that tended to blur the invention and patentable invention. *See Liivak, supra* note 9, at 45. Patent law referred both to the concrete solution created by the inventor as well as a descriptor indicating whether that solution was a significant advance over the prior art (what we today call nonobviousness). *Id.* That usage was unfortunate. As used here, the invention is just a neutral reference to the solution created by the inventor.

53. GEORGE TICKNOR CURTIS, A TREATISE ON THE LAW OF PATENTS FOR USEFUL INVENTIONS IN THE UNITED STATES OF AMERICA 129-30 (3d ed. 1867) (“[T]he question in all cases is, *first*, what is the invention; and, *secondly*, is that invention a patentable subject . . .”).

54. *Electric R.R. Signal Co. v. Hall Ry. Signal Co.*, 114 U.S. 87, 96 (1885).

sired result, the object of the endeavor, is *not* the invention.<sup>55</sup> Defining the invention as the solution to the problem is helpful, but that certainly does not fully define the invention. After all, the solution created by the inventor can be generalized at many levels of abstraction.<sup>56</sup> At what level of generality can we identify the solution created by the inventor?<sup>57</sup> Though some have given up hope for a doctrinal resolution, the following Parts show that patent law already has a well-developed notion of the invention, and as shown below, the correct level of abstraction is actually quite low, focusing on the embodiments disclosed in the patent.

### *C. The Invention Is the Set of Disclosed Embodiments*

As this Article argues for the notion that the invention is a set, this Part begins by establishing what constitutes elements of that set. And though it surely sounds pedantic, this Article argues that the invention is the set of things invented by the inventor. This Part first shows that inventing is the act of creating a specific, complete, and real solution to a technological problem. The Part then proceeds to show that the invention is simply the set of things invented and disclosed (i.e., the set of embodiments).<sup>58</sup>

To that end, it is useful to consider what it means to invent. In patent jargon, inventors invent operable embodiments. The real, tangible characteristic of invented things can be seen in the threshold requirement of 35 U.S.C. § 101.<sup>59</sup> It establishes the things that can be considered by the patent system.<sup>60</sup> It states that “[w]hoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.”<sup>61</sup> In other words, inventors invent “process[es] machine[s], manufacture[s], or composition[s] of matter.”<sup>62</sup> These are all real things, as opposed to metaphysical constructs or abstractions. These things are real in the sense that invented things are either

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55. *See id.*

56. *See* Chiang, *supra* note 20, at 1099.

57. *See* Dan L. Burk & Mark A. Lemley, *Quantum Patent Mechanics*, 9 LEWIS & CLARK L. REV. 29, 51 (2005).

58. *But see* Kevin Emerson Collins, *Getting into the “Spirit” of Innovative Things: Looking to Complementary and Substitute Properties to Shape Patent Protection for Improvements*, 26 BERKELEY TECH. L.J. 1217, 1220 (2011) (arguing against using embodiments as the primitives of claim scope).

59. *See* 35 U.S.C. § 101 (2006).

60. *See id.*

61. *Id.*

62. *Id.*; *see also* 35 U.S.C. § 115 (2006) (“The applicant shall make oath that he believes himself to be the original and first inventor of the process, machine, manufacture, or composition of matter, or improvement thereof, for which he solicits a patent . . .”).

physical objects (machines, manufactures, compositions of matter) or they are specific physical acts (processes and methods).<sup>63</sup>

Not only are these embodiments real, but they are complete and specific. Other references to inventing or inventors in patent law focus on the notion of conception.<sup>64</sup> For inventorship, patent law determines *who* invented an invention based on conception, as “[c]onception is the touchstone of inventorship.”<sup>65</sup> For priority determinations, patent law determines *when* an inventor invents based on conception.<sup>66</sup> Consistent with these cases, determining *what* was invented should also begin by looking to the inventor’s conception. As noted in *O’Reilly v. Morse*, when the Court turned to “ascertain and settle, what is the thing which was invented,” the Court instructed “to this end it will be most convenient to begin at its conception.”<sup>67</sup>

In particular, conception elaborates on the notion of the inventor’s specific means for solving some problem. “Conception is the ‘formation in the mind of the inventor, of a definite and permanent idea of the complete and operative invention, as it is hereafter to be applied in practice.’”<sup>68</sup> In accord with the discussion above, “[i]t is not sufficient that the result to be obtained be conceived, but it is required that there be conceived and disclosed the means provided to accomplish that result.”<sup>69</sup>

Importantly, conception is complete when “[a]ll that remains to be accomplished in order to perfect the act or instrument belongs to the department of construction, not invention.”<sup>70</sup> It is complete “when [the idea] has assumed such shape in the mind that it can be described and illustrated; when the inventor is ready to instruct the mechanic in relation to putting it in working form.”<sup>71</sup> A conception is complete and capable of being reduced to practice when an inventor is able to tell the ordinary mechanic both *what* is the specific, complete invention as well as *how* to make and use that invention.

63. See Tun-Jen Chiang, *Forcing Patentee Claims* 7 (George Mason Univ. Law & Econ. Research Paper Series, Paper No. 12-51), available at [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2130961](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2130961) (articulating a view of embodiments as real but where the invention is an abstraction).

64. This section adapts in part the discussion from Liivak, *supra* note 9, at 20-21.

65. See *Burroughs Wellcome Co. v. Barr Labs., Inc.*, 40 F.3d 1223, 1227-28 (Fed. Cir. 1994).

66. See *Marconi Wireless Tel. Co. of Am. v. United States*, 320 U.S. 1, 34-35 (1943) (“It is well established that as between two inventors priority of invention will be awarded to the one who by satisfying proof can show that he first conceived of the invention.”).

67. *O’Reilly v. Morse*, 56 U.S. (15 How.) 62, 68 (1854).

68. *Hybritech Inc. v. Monoclonal Antibodies, Inc.*, 802 F.2d 1367, 1376 (Fed. Cir. 1986) (quoting 1 WILLIAM C. ROBINSON, *THE LAW OF PATENTS FOR USEFUL INVENTIONS* § 532 (1890)); see *Field v. Knowles*, 183 F.2d 593, 611 (C.C.P.A. 1950).

69. *Field*, 183 F.2d at 611 (emphasis omitted).

70. *Mergenthaler v. Scudder*, 11 App. D.C. 264, 276, 1897 Dec. Comm’r Pat. 724, 731 (D.C. Cir. 1897).

71. *Cameron v. Brick*, 1871 Dec. Comm’r Pat. 89, 90.

In their casebook, John Duffy and Robert Merges emphasize that “conception” in patent law demands rigor:

There must be a “definite” and “permanent” idea of the “complete” and “operative” invention. Conception does not occur until the inventive idea is “crystallized in all of its essential attributes and becomes so clearly defined in the mind of the inventor as to be capable of being converted to reality and reduced to practice by the inventor or by one skilled in the art.”<sup>72</sup>

The result is that people invent real, completed embodiments that are ready to be usefully applied by “any” person of skill in the art.<sup>73</sup>

Having shown that the things that are invented are real, specific, and complete embodiments, we can now ask what exactly is the invention. In particular, how does the invention relate to the thing or things invented? Is the invention defined according to its plain meaning as the set of things invented, or is the invention defined more broadly as something more abstract than the thing invented?

On this critical and not insubstantial question, foundational Supreme Court cases point in what appear to be opposing directions. The simplest and clearest definition of the invention is the set of things invented.<sup>74</sup> Indeed, there is very strong support for this view. In numerous cases, the Court has emphasized that “[the patentee] can lawfully claim only what he has invented . . . .”<sup>75</sup> An inventor can claim “the exclusive right to use the means he specifies to produce the result or effect he describes, and nothing more . . . . And any one may lawfully accomplish the same end without infringing the patent, if he uses means substantially different from those described.”<sup>76</sup> All of these cases provide strong support for defining the invention as the set of disclosed embodiments and furthermore support limiting patent scope to that disclosed invention.

Yet an alternative line of cases appears to point in a different direction. Those cases specifically reject protecting just the “mere form” of any one particular embodiment. Variations “merely in form or pro-

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72. MERGES & DUFFY, *supra* note 26 at 459 (quoting *Brown v. Barbacid*, 276 F.3d 1327 (Fed. Cir. 2002)).

73. 35 U.S.C. § 112 (2006) (emphasis added).

74. *But see* Timothy R. Holbrook, *Possession in Patent Law*, 59 SMU L. REV. 123 (2006) (arguing for conceptualizing the invention as more than what was invented).

75. *O'Reilly v. Morse*, 56 U.S. (15 How.) 62, 121 (1854); *see also* *Ensten v. Simon, Ascher & Co.*, 282 U.S. 445, 452-53 (1931) (describing the “principle which forbids a patentee to assert a right to more than he has actually invented”) (quoting 2 ROBINSON, *supra* note 68, at 284 (1890)); *Agawam Co. v. Jordan*, 74 U.S. (7 Wall.) 583, 602 (1869) (“No one is entitled to a patent for that which he did not invent . . . .”); *O'Reilly*, 56 U.S. (15 How.) at 120 (describing the “[t]he evil . . . if [a patentee] claims more than he has invented, although no other person has invented it before him.”).

76. *O'Reilly v. Morse*, 56 U.S. (15 How.) 62, 119 (1854); *see also* *Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co.*, 535 U.S. 722, 736 (2002) (“What is claimed by the patent application must be the same as what is disclosed in the specification . . . .”).

portions" that still are "substantially and essentially the same [as the patented thing] will be a violation of the patentee's right."<sup>77</sup> As stated by the Court, "[t]hough the mental concept is embodied or realized in a mechanism or a physical or chemical aggregate, the embodiment is not the invention and is not the subject of a patent."<sup>78</sup> Instead, "[a] patentable invention is a mental result. It must be new and shown to be of practical utility. Everything within the domain of the conception belongs to him who conceived it. The machine, process, or product is but its material reflex and embodiment."<sup>79</sup>

In his oft-cited 1890 treatise, Robinson emphasized the proposition "that the subject-matter covered by a patent is the principle of the invention."<sup>80</sup> The "principle is the true subject-matter of the patented invention."<sup>81</sup> Even earlier, Curtis noted that "[l]earned judges have often laid it down that, where two things are the same in principle, the one is an infringement upon the other" and "there is a sense in which the principle of an invention is undoubtedly to be considered, in determining whether an infringement has taken place."<sup>82</sup>

Justice Story emphasized this point when he described patent infringement as "whether the machines used by the defendant are substantially, in their principles and mode of operation, like the plaintiff's machines. If so, it was an infringement of the plaintiff's patent to use them."<sup>83</sup> In the foundational case of *Winans v. Denmead*, the Supreme Court, referring to the principle of the invention as the "mode of operation," emphasized that:

[T]his new mode of operation is, in view of the patent law, the thing entitled to protection. The patentee may, and should, so frame his specification of claim as to cover this new mode of operation which he has invented; and the only question in this case is, whether he has done so; or whether he has restricted his claim to one particular geometrical form.<sup>84</sup>

And even later, in *Continental Paper Bag*, the Court again reiterated that patents protect the "principle" of the invention.<sup>85</sup>

Initially, these cases focusing on the principle of the invention appear inconsistent with cases limiting patent scope to the disclosed

77. WILLARD PHILLIPS, *THE LAW OF PATENTS FOR INVENTIONS* 372 (1837).

78. *United States v. Dubilier Condenser Corp.*, 289 U.S. 178, 188 (1933).

79. *Smith v. Nichols*, 88 U.S. (21 Wall.) 112, 118 (1875).

80. 1 ROBINSON, *supra* note 68, § 134, at 191.

81. *Id.* § 141, at 201.

82. GEORGE TICKNOR CURTIS, *A TREATISE ON THE LAW OF PATENTS FOR USEFUL INVENTIONS IN THE UNITED STATES OF AMERICA* § 219, at 321 (2d ed. 1854).

83. *Odiorne v. Winkley*, 18 F. Cas. 581, 582 (C.C.D. Mass. 1814) (No. 10,432) (Story, Circuit Justice).

84. *Winans v. Denmead*, 56 U.S. (15 How.) 330, 341 (1854).

85. *Cont'l Paper Bag Co. v. E. Paper Bag Co.*, 210 U.S. 405, 418-19 (1908); *see also* Chiang, *supra* note 20, at 1098 ("[P]atents protect the 'principle' of the invention . . .").



embodiments. Rather than pointing to the concrete and clear objective evidence of the disclosed embodiments, these cases are directing patent law's attention away from the mere "form" of any one embodiment to the more abstract notion of the principle of the invention. In fact, these cases have led some to argue that patent scope should extend beyond the disclosed embodiments and should capture some more abstract notion.<sup>86</sup>

As will be shown below, I think that this misreads those cases. By referring to the principle of the invention, those cases were certainly trying to avoid restricting the inventor to any one particular embodiment, but they were not untethering the invention from the *set* of things invented and disclosed in the patent.<sup>87</sup> In fact, most of the principle-of-the-invention cases are facially equivalent to the notion of the invention as the set of explicitly disclosed embodiments. And importantly, they should not be viewed as antithetical to the idea of the invention as the disclosed embodiments. Instead, they provide insight into the way a patentee can disclose embodiments that can reach into after-arising technology. The following Part explores this understanding of the principle of the invention.

#### *D. The Principle of the Invention Is the Set of Disclosed Embodiments*

The previous Part highlighted two lines of Supreme Court cases. One line limits a patent's exclusive rights to the embodiments invented and disclosed in the patent itself. The other line looks beyond any one embodiment and links a patent's scope to the more abstract principle of the invention. This Part explains how these two lines, which appear inconsistent, are in fact describing the same concept.

Before venturing further to explore the relationship between the principle and the invention, it is worthwhile to (again) be careful with even more patent terminology. First, the principle of the invention is not what might come to mind to the average reader. As it relates to technology, most might assume that the principle of the invention relates to the basic scientific principles that back some technological advance. Indeed "[i]n one sense, the word 'principle' denotes the physical force employed by an invention."<sup>88</sup> Patent law, though, has not used the principle to refer to these scientific principles. As emphasized by Justice Story, "the principles of a machine . . . [does] not mean[] the original elementary principles of motion, which phi-

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86. See Chiang, *supra* note 38, at 1214-15.

87. The contrast between these two lines of Supreme Court cases mirrors a similar contrast between Federal Circuit cases that, on the one hand, refuse to import limitations to patent scope from any one embodiment, while on the other do restrict patent scope where the patent discloses nothing but that one embodiment.

88. 1 ROBINSON, *supra* note 68, § 135, at 193.

losophy and science have discovered . . . .”<sup>89</sup> “No one . . . in the least acquainted with law, would for a moment contend, that a principle in this sense is the subject of a patent . . . .”<sup>90</sup> And these prohibitions remain to this day in patent law’s interpretation of 35 U.S.C. § 101, the statutory provision seen as the initial gatekeeper for statutory subject matter. Recently, the Supreme Court reaffirmed that despite generally broad patent eligibility, there remained three important exceptions to patentable subject matter, stating that “laws of nature, physical phenomena, and abstract ideas” continue to be excluded from patent eligibility.<sup>91</sup>

Instead of referring to the underlying scientific principles, the principle of the invention (or as it has been alternatively referred to, the “mode of operation,”<sup>92</sup> “modus operandi,”<sup>93</sup> or the “idea of means”<sup>94</sup>) refers to the essential elements of the operative embodiments. In defining the invention, these cases look beyond the “mere form” and its specifics. *Robinson on Patents* describes the principle of the invention as:

[T]he spirit of the invention, that characteristic thought which is embodied in the operative means devised by the inventor. In reference to a machine, it is defined as its ‘modus operandi,’ its ‘structure and constituent parts,’ in reference to all inventions, as ‘the mode of applying powers to produce results,’ the ‘operative cause by which a certain result is produced,’ ‘the manner of producing the effect.’<sup>95</sup>

The critical step is to understand the invention not as one particular embodiment, but rather as the set of embodiments disclosed in the patent. In other words, though a patent’s specification may well focus on one preferred embodiment, that one embodiment certainly is not usually the only embodiment disclosed. The principle of the invention should be seen as the feature or features found in common in all of those disclosed embodiments. By understanding the invention

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89. *Whittemore v. Cutter*, 29 F. Cas. 1123, 1124 (C.C.D. Mass. 1813) (No. 17,601) (Story, Circuit Justice); *see also* *Le Roy v. Tatham*, 55 U.S. (14 How.) 156, 174-75 (1853) (“It is admitted, that a principle is not patentable. A principle, in the abstract, is a fundamental truth; an original cause; a motive; these cannot be patented, as no one can claim in either of them an exclusive right.”).

90. *CURTIS*, *supra* note 82, § 219, at 321 n.1 (quoting *Barrett v. Hall*, 2 F. Cas. 914, 923 (C.C.D. Mass. 1818) (No. 1,047) (Story, Circuit Justice)).

91. *Bilski v. Kappos*, 130 S. Ct. 3218, 3225 (2010) (“[T]hese exceptions have defined the reach of [35 U.S.C. § 101] as a matter of *stare decisis* going back 150 years.” (citing *Le Roy*, 55 U.S. (14 How.) at 174-75 (1853))).

92. This is distinct from the statutory command to “explain the principle and the several modes in which he has contemplated the application of that principle . . . .” Patent Act of 1836, ch. 357, § 6, 5 Stat. 117.

93. *Whittemore*, 29 F. Cas. at 1124.

94. 1 *ROBINSON*, *supra* note 68, § 139, at 199 (“All these phrases evidently refer to the idea of means.”).

95. *Id.* § 139, at 198.

as the set of disclosed embodiments, these two lines of cases can be reconciled. Limiting patent scope to the principle of the invention is in fact equivalent to limiting patent scope to the disclosed embodiments.

The connection between the two is that when the inventor can understand and disclose why one embodiment works to solve the problem at hand, the inventor often can also disclose alternative embodiments. In other words, an inventor who understands the principles that underlie the success of one embodiment can often disclose a large set of related embodiments that will similarly work to solve the problem at hand.

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Already 150 years ago it was understood that this heady mix of the invention and the principle of the invention was challenging. Then, as now, “[p]erhaps the best method for the treatment of this subject will be to select some prominent and peculiar invention, as an illustration of the question [of the principle of the invention] . . . .”<sup>96</sup> This Article follows Curtis’s lead and now also explores some prominent cases that help to illustrate these issues.

Importantly, the cases that follow show that two classes of cases were relevant under the aegis of the principle of the invention, and both are quite compatible with the notion of the invention as the set of disclosed embodiments. One mode of disclosure allowed the inventor to simply list off explicit structurally defined alternative embodiments. By showing which features of the embodiments could be replaced or substituted by other elements, the inventor disclosed a broad set of alternative embodiments and therefore a broad invention. Patent scope could then extend to any one of these explicitly disclosed embodiments. Other cases similarly allow a broad disclosure, but they do so not through explicit structural alternatives, but rather through what I call the generalized embodiment. As discussed below, it is this generalized embodiment that depends in part on functionally disclosed elements and that type of disclosure enables the invention to reach after-arising technology. In either case, this ability to generalize and enumerate a large set of related alternative embodiments was the hallmark of broad inventorship and is necessary for broad patent scope.

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96. CURTIS, *supra* note 53, § 124, at 106.

### 1. *Disclosing Explicit Alternatives*

*Tilghman v. Proctor* provides an example of a patentee who disclosed a broad set of alternate embodiments.<sup>97</sup> Richard Tilghman invented a process for separating fatty acids and glycerine from fatty bodies by mixing the fatty bodies with water and then subjecting the mixture to a high temperature and high enough pressure to keep the liquid water in the mixture from converting to steam.<sup>98</sup> In his patent application, he disclosed his best mode but yet in critical areas he further noted that his process would work with parameters different from his disclosed best mode.<sup>99</sup> In short, he disclosed variations on his best mode and each of these variations disclosed a multitude of alternate embodiments.

He described variations in vessels that could be employed,<sup>100</sup> and he described variations in temperature that could be employed.<sup>101</sup> The evidence in the case made it clear that Tilghman had indeed conceived a very general process and had disclosed the specifics of his best mode along with all the numerous variations of his invented process. A broad claim in this case was sustained, as Tilghman had conceived a broadly applicable process and had disclosed the breadth of those embodiments in his specification.<sup>102</sup>

*Continental Paper Bag Co. v. Eastern Paper Bag Co.* is another case that allows broad claims where alternate embodiments are disclosed.<sup>103</sup> In allowing the broad claims, the Court stated that:

We think it is clear that the court considered that [the inventor] sought to comply with [the disclosure requirements of the patent statute]. In other words, he filed a description of his invention, explained its principle and the best mode in which he ‘contemplated applying that principle,’ and did not intend to give up all other modes of application. An inventor must describe what he conceives to be the best mode, but he is not confined to that. If this were not so most patents would be of little worth. ‘The principle of the invention is a unit, and invariable; the modes of its embodiment in the concrete invention may be numerous and in appearance very different from each other. . . .’ Liddell was explicit in the declaration that there might be alternatives for the device described and illustrated by him. He was explicit in saying that, in place of the device for controlling the movement of the forming plate relatively

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97. *Tilghman v. Proctor*, 102 U.S. 707 (1881).

98. *Id.* at 712-13.

99. *See id.* at 730-33.

100. *Id.* at 730.

101. *Id.* at 732-33.

102. *Id.* at 726.

103. *Cont'l Paper Bag Co. v. E. Paper Bag Co.*, 210 U.S. 405, 417-19 (1908).

to the cylinder that the plate might be moved or operated by any other suitable means.<sup>104</sup>

Both of these cases underscore one (relatively easy) way in which inventors are granted broader patent scope: disclosing explicit alternative embodiments.

It should be noted that these cases do not suggest that inventors who disclosed such alternatives can have broad patent scope in all possible facets of their invention. It is precisely those specific features of the embodiments for which alternatives are provided that receive broader protection. Where some feature does not or cannot have alternative structures, patent scope will be quite narrow in that particular feature. This concept is further described below in discussing narrow inventorship and found inventions.

## 2. *Disclosing a Generalized Embodiment*

In addition to disclosing specific alternative embodiments, broad inventorship and the principle of the invention cases allowed an inventor to disclose broadly by disclosing the essential features of alternative embodiments. In a sense, an abstracted, generalized embodiment is disclosed. Rather than disclosing specific exemplars of alternative embodiments, the inventor provides more generalized instructions that, though general, can still direct a person of skill, *without more*, to make and use the conceived embodiment. As shown later, this variant becomes critical to allowing patent scope to extend to after-arising technology.

A good example of this type of disclosure is found in *Neilson v. Harford*.<sup>105</sup> Though an English patent case, *Neilson* has been relied upon heavily and repeatedly by the Supreme Court in foundational cases like *Tilghman v. Proctor*,<sup>106</sup> *O'Reilly v. Morse*,<sup>107</sup> and even more recently in *Parker v. Flook*.<sup>108</sup> Neilson invented a process for improving the performance of blast furnaces by preheating the air being pumped into the furnace.<sup>109</sup> He achieved this by placing a receptacle between the bellows and the furnace itself.<sup>110</sup> By externally heating the receptacle, the blast air was preheated before reaching the furnace.<sup>111</sup> This raised the furnace temperature and made smelting more effective.<sup>112</sup>

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104. *Id.* (quoting 2 ROBINSON, *supra* note 68, § 485) (citations omitted).

105. *Neilson v. Harford*, (1841) 151 Eng. Rep. 1266 (Exch. of Pleas); 8 M. & W. 806.

106. 102 U.S. 707, 722 (1881).

107. 56 U.S. 62, 114-18 (1854).

108. 437 U.S. 584, 592 (1978).

109. *Neilson*, 151 Eng. Rep. at 1267.

110. *Id.*

111. *Id.*

112. *Id.*

As relayed in the case, Neilson described the embodiments that made up his invention in general terms.<sup>113</sup> He generalized the embodiments that constituted his invention, but in an important respect he went beyond listing specific alternatives and instead defined the extent of the invention by arguing that certain properties were immaterial.<sup>114</sup> In so doing, he relatively and directly outlined the contours of the invention.<sup>115</sup> The court relays that:

[I]n this specification, after stating that air heated up to red heat may be used, but that it is not necessary to go so far to produce a beneficial effect, he proceeds to state that the size of the receptacle will depend on the blast necessary for the furnace, and gives directions as to that; and then he adds, the shape of the receptacle is 'immaterial to the effect, and may be adapted to local circumstances. . . .' To be valid, we think it should be such as, if fairly followed out by a competent workman, without invention or addition, would produce the machine for which the patent is taken out, and that such machine, so constructed, must be one beneficial to the public. . . .

In the first sentence, the patentee, speaking of the temperature being so high as that of a red heat, adds, 'that so high a temperature is not absolutely necessary to produce a beneficial effect;' then he adds, that the receptacle may be made of iron, 'but as the effect does not depend upon the nature of the material, other metals or convenient materials may be used.'<sup>116</sup>

In other words, Neilson provides directions that are rather broadly applicable. Importantly, despite that generality the instructions are not vague; they still must be detailed enough to be "followed out by a competent workman, without invention or addition."<sup>117</sup>

In reviewing the case, the Supreme Court focused on these aspects as critical to the broad patent scope afforded to Neilson. The Court noted that:

[Neilson] pointed out the manner in which it might be done; but admitted that it might also be done in a variety of ways; and at a higher or lower temperature; and that all of them would produce the effect in a greater or less degree, provided the air was heated by passing through a heated receptacle. . . . And this effect was always produced, whatever might be the form of the receptacle, or

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113. *Id.*

114. *Id.*

115. This Article focuses on disclosing the invention and not necessarily on techniques for claiming that disclosed invention. Nonetheless, there will certainly be a close kinship between the language used to disclose this generalized embodiment and the language used to claim it.

116. *Neilson*, 151 Eng. Rep. at 1273-74.

117. *Id.* at 1274. This standard is more strict than the "undue experimentation" that is associated with modern enablement. *See In re Wands*, 858 F.2d 731 (Fed. Cir. 1988).

the mechanical contrivances for heating it, or for passing the current of air through it, and into the furnace.<sup>118</sup>

Neilson was able to generalize the shape and size of the receptacles that would work, and though he did not explicitly disclose every size and shape, he did so in effect, by stating that the shape was immaterial. Similarly, he noted that the material to be used “may be made of iron” but “other metals or convenient materials may be used.”<sup>119</sup>

In modern patent scholarship this concept of the generalized embodiment has surfaced in recent discussions of the doctrine of equivalents. For example, Craig Nard and Michael Meurer describe techniques that allow claims to be drafted to cover after-arising technology. That same idea is relied on here to show that an inventor, by following *Neilson*, can also disclose concrete embodiments that a future person of skill in the art can follow. Nard and Meurer relate that:

Surprisingly, certain claim-drafting techniques allow inventors to claim technology that incorporates elements that have not been developed. Consider for example a patentable tennis racket that differs from previous rackets in terms of its shape and dimensions. The inventor must describe a suitable material for use in the racket, but should avoid limiting herself to a particular material. In recent years, rackets have become lighter and stronger, as manufacturers moved from wood to aluminum to graphite. An inventor, familiar with this trend, should describe the material used to make his racket in general terms, and then the patent claim will literally cover a racket of the same shape and dimension even if it is made from a substance that was not known at the time of the patent application.<sup>120</sup>

This technique described by Meurer and Nard is quite similar to the notion in *Neilson* in which the inventor disclosed that certain aspects of the embodiments were not material. In science and engineering the use of standards for technical instructions has been quite common for some time. Rather than always giving explicit instructions as to structure, engineers often are instead given functional instructions that they nonetheless are able to follow without more. Standard-setting bodies such as the American Society for Testing Materials (ASTM) are designed specifically to allow such communication and functional quality assurance.<sup>121</sup> For example, ASTM originated

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118. *O'Reilly v. Morse*, 56 U.S. (15 How.) 62, 115-17 (1854).

119. *Neilson*, 151 Eng. Rep. at 1274 (internal quotation marks omitted).

120. Michael J. Meurer & Craig Allen Nard, *Invention, Refinement and Patent Claim Scope: A New Perspective on the Doctrine of Equivalents*, 93 GEO. L.J. 1947, 1976-77 (2005).

121. See ASTM INT'L, <http://www.astm.org/ABOUT/aboutASTM.html> (last visited Jan. 17, 2013).

from attempts to standardize the type and quality of steel used for constructing railroads.<sup>122</sup>

In an early example of such a disclosure, the shape of the furnace in *Neilson* was immaterial<sup>123</sup> and in the case of Meurer and Nard's tennis racket it was the exact material from which the racket was constructed.<sup>124</sup> Of course, it was not enough to just say that any material could work, but rather an inventor would disclose what mechanical properties were necessary. These "conditions" are important and tied closely to an inventor's understanding of the inner workings of an embodiment. Interestingly, some of the more helpful discussions of the principle of the invention focus on exactly this type of generalization and its related conditions.

Justice Bushrod Washington, nephew of George Washington, described the principle of the invention in the following way:

What constitutes form, and what principle, is often a nice question to decide; and upon none, are the witnesses who are examined in patent causes, even those who are skilled in the particular art, more apt to disagree. It seems to me that the safest guide to accuracy in making the distinction is, first to ascertain what is the result to be obtained by the discovery; and whatever is essential to that object, independent of the mere form and proportions of the thing used for the purpose, may generally, if not universally, be considered as the principle of the invention.<sup>125</sup>

The focus is on the parts and features of the embodiments that are common to all of the disclosed embodiments (therefore essential insofar as that patent specification is concerned) to solving the problem in the way the inventor has envisioned. As put by Justice Story, "[t]he true legal meaning of the principle of a machine, with reference to the Patent Act, is, the peculiar structure or constituent parts of such machine."<sup>126</sup> Again, the principle of the invention follows the physical structures or parts that are shared by all the disclosed embodiments. Recently the Federal Circuit has used a similar formulation:

[T]his court recognizes that it must interpret the claims in light of the specification, yet avoid impermissibly importing limitations from the specification. That balance turns on how the specification characterizes the claimed invention. In this respect, this court looks to whether the specification refers to a limitation only as a part of less than all possible embodiments or whether the specifi-

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122. See WIKIPEDIA, [http://en.wikipedia.org/wiki/ASTM\\_International](http://en.wikipedia.org/wiki/ASTM_International) (last visited Jan. 17, 2013); see generally JOHN PERRY, *THE STORY OF STANDARDS* (1955).

123. *Neilson*, 151 Eng. Rep. at 1274.

124. Meurer & Nard, *supra* note 120, at 1976.

125. *Treadwell v. Bladen*, 24 F. Cas. 144, 146 (C.C.E.D. Pa. 1827) (No. 14,154); see also CURTIS, *supra* note 53, § 219, at 321 n.1.

126. *Barrett v. Hall*, 2 F. Cas. 914, 923 (C.C.D. Mass. 1818) (No. 1047).



cation read as a whole suggests that the very character of the invention requires the limitation be a part of every embodiment.<sup>127</sup>

When an inventor understands why one embodiment works, he or she can then often conceive and reduce to practice other related embodiments that will similarly work. When that is done, then indeed any one particular embodiment should not limit patent scope. Or, as put by Robinson, the invention should be something bigger than any one particular embodiment as “the modes of its embodiment in a concrete invention may be numerous and, in appearance, very different from each other.”<sup>128</sup>

### *E. The Disclosed Invention and the Disclosed Principle*

Though it was somewhat inherent in the above discussion, it is worth emphasizing that even for the principle of the invention cases, the focus of the investigation did not extend beyond the objective evidence *disclosed* in the patent itself. For example, even understanding that the principle of the invention refers to the essential structural components of the embodiments requires determining the structural features that are common to all of the *disclosed* embodiments. This is important because otherwise these principle of the invention cases could be misinterpreted to disconnect patent scope from the disclosure. For example, some might mistakenly think that the principle can be developed ex post after the patent is filed (perhaps as part of litigation).

As shown below, the Court clearly defined the principle of the invention as the *disclosed* principle in the specification itself. It was not developed ex post during litigation by theorizing how the invention works. This is an important feature of the concept of the invention that limits the invention to the objective disclosed patent and reduces the ability for later gamesmanship during litigation.

In *Winans v. Denmead*, the Supreme Court stated that the “mode of operation” (a synonym for the principle of the invention) can be found by studying “what appears on the face of the specification”<sup>129</sup> and the infringement determination focuses on whether the defendant uses “the same mode of operation as that described by the patentee.”<sup>130</sup> In other words, we need not search far for the principle of the invention—it must be disclosed in the patent itself. The Court

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127. *Alloc, Inc. v. ITC*, 342 F.3d 1361, 1370 (Fed. Cir. 2003) (internal citations omitted); see also F. SCOTT KIEFF ET. AL., *PRINCIPLES OF PATENT LAW* 856 (5th ed. 2011).

128. 2 ROBINSON, *supra* note 68, § 485, at 75; see also *Cont'l Paper Bag Co. v. E. Paper Bag Co.*, 210 U.S. 405, 417-19 (1908).

129. 56 U.S. 330, 339 (1854).

130. *Id.* at 340; see also *id.* at 342 (“[I]t being a familiar rule that, to copy the principle or mode of operation described, is an infringement, although such copy should be totally unlike the original in form or proportions.”).

stated that patent scope “cover[s] the described mode of operation by which the result is attained.”<sup>131</sup> As summed up by one of the most influential treatises of the nineteenth century, infringement:

[I]nvolves substantial identity, whether that identity is described by the terms, “same principle,” same *modus operandi*, or any other. It is a copy of the thing described in the specification of the patentee, either without variation, or with only such variations as are consistent with its being, in substance, the same thing.<sup>132</sup>

That these Supreme Court cases and treatises were referring to the *disclosed* principle should come as no surprise. From 1793 until 1952, the statutory disclosure requirement had an extra requirement explicitly for patents claiming *machines*. The patent specification was required to “fully explain the principle and the several modes in which he has contemplated the application of the principle. . . .”<sup>133</sup> This understanding is not only supported by these historic cases, but it also ensures that any embodiments that are covered by the patent are in fact embodiments conceived and reduced to practice by the inventor. It ensures that patent scope extends only to “what they themselves have created.”<sup>134</sup>

#### F. Keeping the Invention Rooted to Embodiments

As the above discussion makes clear, patent law allows patent scope to extend beyond any one particular embodiment in some cases. The danger is that this process of abstraction could become unwieldy and lead to patents with wholly unpredictable scopes. In other words, if patent law allowed its reach to go beyond the embodiments disclosed, then some rightfully worry that “there is no obvious principled limit to this abstraction process.”<sup>135</sup>

Yet as suggested above, broad inventorship and its broad patent scope will not necessarily lead to vague boundaries. The key is that the abstraction process is still strongly tethered not to one embodiment but instead to the well-defined *set* of all *disclosed* embodiments. This subtle point was made in an early and influential English patent case. In *Boulton v. Bull* the court recognized that “it is necessary to inquire, what is meant by a principle reduced to practice. It can only mean a practice founded on principle, and that practice is the thing done or made. . . .”<sup>136</sup> In other words the principle, though in a

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131. *Id.* at 338-39.

132. CURTIS, *supra* note 53, § 220, at 322.

133. Patent Act of 1836, ch. 357, § 6, 5 Stat. 117, 119.

134. *Winans*, 56 U.S. at 341.

135. Chiang, *supra* note 38, at 1213.

136. *Boulton v. Bull*, (1795) 126 Eng. Rep. 651 (C.P.) 663; 2 H. Bl. 486; *see also* 1 ROBINSON, *supra* note 68, § 140, at 200-01.

sense abstract, must still be tied to the disclosed embodiments that have been reduced to practice.

Along similar lines, Justice Story made clear that, though there is a focus on the principle of the invention, this principle never strays far from actual machines or processes. In *Blanchard v. Sprague*, a circuit court case cited later in *O'Reilly v. Morse*, Justice Story explained:

Looking at the present specification, and construing all its terms together, I am clearly of opinion, that it is not a patent claimed for a function, but it is claimed for the machine specially described in the specification; that is, not for a mere function, but for a function as embodied in a particular machine, whose mode of operation and general structure are pointed out. . . . This seems to me sufficiently expressive to define and ascertain what his invention is. It is a particular machine, constituted in the way pointed out, for the accomplishment of a particular end or object. The patent is for a machine, and not for a principle or function detached from machinery.<sup>137</sup>

Robinson summed these ideas and stated that:

The principle or essence of an invention, however, when taken by itself, is no more patentable than the principle or force which it proposes to employ. Like that, it is but an abstraction, resting in theory alone, and not an operative means. Until reduced to practice it is not a complete invention, nor does it stand on any higher ground of legal merit than the discovery of an existing natural power. It must become 'a principle, put in practice and applied,' a 'practice founded on principle,' before it passes from the shadowy regions of mere intellectual apprehension into the domain of the industrial arts.<sup>138</sup>

Curtis, in his influential treatise, specifically acknowledged the pitfalls of allowing patent scope to extend to the principle of the invention, and he similarly felt patent law could avoid these problems so long as it tethered the principle to operable embodiments. He advised that:

The danger of claiming an abstract principle will be avoided by the use of appropriate terms, signifying that the application of the principle is claimed as effected by the means used and described by the patentee, and by all other means which, when applied within the just scope of his conditions, will perform, for the purpose of the application, the like office.<sup>139</sup>

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137. *Blanchard v. Sprague*, 3 F. Cas. 648, 650 (C.C.D. Mass. 1839) (No. 1,518).

138. 1 ROBINSON, *supra* note 68, § 140, at 200-01 (footnotes omitted). Though it is beyond the scope of this Article, Robinson's reference to an "abstraction" provides a highly relevant, unexplored explanation for the origins of the abstract ideas doctrine that is now causing much consternation in patentable subject matter. *See generally* *Bilski v. Kappos*, 130 S. Ct. 3218 (2010).

139. CURTIS, *supra* note 53, § 166, at 152.

In sum, though it enables patent scope to extend beyond any one embodiment, the invention is limited to the disclosed embodiments whether those embodiments are disclosed structurally or functionally.

### III. NARROW INVENTORSHIP: UNABLE TO GENERALIZE ELEMENTS

Though the previous Part spent considerable time exploring when and how a patentee can attain broad patent scope, those opportunities are not available in every case. As suggested in the discussion of 35 U.S.C. § 101, to be patent eligible, the patentee must have invented something.<sup>140</sup> In other words a patentee must have invented at least one embodiment. And having just one embodiment does not entitle the patentee to anything more than that one embodiment. As detailed above, broad inventorship entails disclosing alternative embodiments. But not every inventor is able to generalize to disclose alternatives. When the inventor does not generalize and does not provide alternatives, the set of disclosed embodiments is small and patent scope is correspondingly narrow.

Narrow inventorship happens in two ways. First, an inventor might invent broadly yet (perhaps from poor advice from the prosecuting patent attorney) disclose just one embodiment. Since the inventor provided no proof of a broader invention, patent law still treats these inventions as acts of narrow inventorship. Second, and more interesting, are the cases where the inventor just cannot invent broadly. In many important areas, inventors are forced to rely on serendipity or trial-and-error searching to find operable embodiments. In those cases the inventor likely may not understand why the one particular embodiment works. As a result, the inventor cannot disclose alternative embodiments, and the set of disclosed embodiments is very small, often limited to just the one embodiment.

This Part explores this topic of narrow inventorship and shows that patent law has long dealt with this issue especially for inventions that are developed through trial and error. These historical examples have occurred in numerous areas of technology. This Part will explore two early examples relating to plow shape and to light bulb filaments. The Part then proceeds to modern examples of low inventorship. In particular, the Part shows that aspects of inventions in biotechnology fit this mold.

This Part shows that the screening techniques common in modern biotechnology are quite useful in finding embodiments that can solve some highly relevant and important biotechnological problems. But because the screening techniques are essentially trial-and-error techniques, inventors are unable to disclose related embodiments.

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140. See *supra* Part II.

Often, they just know that their one embodiment works but cannot generalize a broader genus of embodiments that will also work. Accordingly, many patents in this area are afforded rather narrow claim scope. This is not the result of extra stringent disclosure requirements that are directed only at the biotechnology industry. Rather, these narrow patents result from narrow inventions.

#### A. Historic Recognition of Narrow Inventorship

In *Winans v. Denmead*, one of the foundational cases establishing notions of broad inventorship, the Supreme Court emphasized that “there may be cases in which the letters-patent do include only the particular form described” and patent scope will be limited to that one disclosed embodiment.<sup>141</sup> In other words, the broad inventorship described above is not available in all cases. The Court in *Winans* went on to explain that such a narrow definition is in entire accordance with what is above stated [about broad inventions]:

The reason why such a patent covers only one geometrical form, is not that the patentee has described and claimed that form only; it is because that form only is capable of embodying his invention; and, consequently, if the form is not copied, the invention is not used.

Where form and substance are inseparable, it is enough to look at the form only. Where they are separable; where the whole substance of the invention may be copied in a different form, it is the duty of courts and juries to look through the form for the substance of the invention—for that which entitled the inventor to his patent, and which the patent was designed to secure; where that is found, there is an infringement; and it is not a defence, that it is embodied in a form not described, and in terms claimed by the patentee.<sup>142</sup>

In supporting its contention that some inventions are in fact narrow and limited in scope, the Court in *Winans* pointed to *Davis v. Palmer*, describing it as “seem[ing] to have been one of those [narrow] cases.”<sup>143</sup> *Davis* was a very early circuit court decision written by Chief Justice Marshall riding circuit in Virginia.<sup>144</sup>

The patent at issue in *Davis* related to an improved shape for the mould boards of plows. In the patent, the inventor described the problem of existing plow shapes, finding that:

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141. *Winans v. Denmead*, 56 U.S. (15 How.) 330, 343 (1854).

142. *Id.* There is something quite interesting in this section of *Winans*. As mentioned earlier, much has been said about central versus peripheral claiming. A similar change can be seen in the style of disclosure. Central disclosure can be seen as disclosure of one specific embodiment along with disclosure of the operative principles of that embodiment. Alternatives need not be explicitly mentioned; the court in *Winans* inferred that they were part of the invention. *Id.*

143. *Id.*

144. *Davis v. Palmer*, 7 F. Cas. 154 (C.C.D. Va. 1827) (No. 3,645) (Marshall, Circuit Justice).

[I]n raising and turning over the furrow-slice, it always either acquires a convex form on the under side, or else it is broken off into pieces, and thrown over; as might therefore be anticipated, it will be found that all these mould-boards [built using prior art straight line designs] wear through in the operation of ploughing about midway, while the upper and lower edges are scarcely rubbed. It also necessarily results, that ploughs of this construction work hard, and are of heavy draught. . . .<sup>145</sup>

From this observation, the inventor in *Davis* then recognized the general problem afflicting the current plow designs: “because the mould-board, not being adapted to the convex form which the furrow-slice is disposed to assume, lifts the furrow-slice at a single point, and that in the middle,” and the inventor then arrived at a better plow design that would lift the furrow-slice “equally . . . throughout the entire operation.”<sup>146</sup>

The inventor then moves to describe his specific plow design:

In order to meet and remedy the inconveniences arising from this form of structure, I form my mould-board into a different shape; and instead of working the moulding part, or face of the mould-board to straight lines, my improvement is to work it to circular or spheric lines. By repeated experiments, I have ascertained, that . . . the circle or segment [sic] to which the mould-board is wrought, should have about three times the radius of the smaller segments . . . the former being about thirty-six inches, the latter twelve. . . . [The resulting shape of the plow] uniformly forms a section of a loxodromic, or spiral curve, and when applied to practice, is found to fit or embrace every part of the furrow-slice, far more than any other shaped plough.<sup>147</sup>

The central issue in the case, one which should ring familiar to any modern patent lawyer, is whether the patent should be limited to the particular plow design that was explicitly disclosed, or whether it could extend to something broader. Chief Justice Marshall relayed that “[t]he counsel for the plaintiff seem disposed to consider . . . the subsequent more particular description, as merely an illustration of the general principle, as one mode of carrying it into execution.”<sup>148</sup> But looking to the patent specification the Chief Justice concluded “we do not think the specification will admit of this [broad] construction.”<sup>149</sup>

*Davis* represents a case where the inventor clearly made some inroads *toward* a generalized solution. He understood that improving plow design required a plow whose shape would turn over the furrow slice, not at one particular point, but “equally . . . throughout the en-

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145. *Id.* at 156.

146. *Id.*

147. *Id.*

148. *Id.* at 157.

149. *Id.*

tire operation.”<sup>150</sup> But that observation, though perhaps important for moving toward a solution, did not itself solve the problem. It was, in an important sense, just the basis for a “research plan.”<sup>151</sup> As admitted by the inventor, to reach the actual design that could actually solve the problem at hand required “repeated experiments.”<sup>152</sup> And the inventor, because of that experimentation, could not disclose a vast array of alternatives. Without those alternatives, the invention was narrow and the patent’s exclusive rights accordingly did not extend much past a plow design, according to the embodiment detailed in the figures.

A very similar line of reasoning resolved the 1887 case of *Snow v. Lake Shore & M.S. Railway*. The patent at issue involved improvements for steam-driven bells on railroad engines. In that case, the Court described the invention and affirmed the finding of noninfringement:

It is not admissible to adopt the argument made on behalf of the appellants, that [the specifics of the preferred embodiment] is to be taken as a mere recommendation by the patentee of the manner in which he prefers to arrange these parts of his machine. There is nothing in the context to indicate that the patentee contemplated any alternative for the arrangement of the piston and piston-rod. The arrangement of the valves, as shown in the drawings, he declared not to be essential, and explained how they might be otherwise adjusted, and the comparative advantage and disadvantage of those plans; but no such language is used in reference to the connection between the piston and its rod.<sup>153</sup>

In their patent specification, the inventors had invented rather broadly along one dimension. They had explicitly disclosed that the arrangement of the valves could be varied, and in this sense the invention tended toward high inventorship, but the inventors made no broadening disclosure with respect to the piston and piston-rod.<sup>154</sup> Without disclosing any alternatives along that dimension, the invention was construed quite narrowly in that respect, deviating little from the specific piston arrangement exemplified in the patent figures.<sup>155</sup>

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150. *Id.* at 156.

151. *Ariad Pharms., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1354 (Fed. Cir. 2010) (en banc).

152. *Davis*, 7 F. Cas. at 156.

153. *Snow v. Lake Shore & M.S. Ry. Co.*, 121 U.S. 617, 630 (1887); *see also* *Cont'l Paper Bag Co. v. E. Paper Bag Co.*, 210 U.S. 405, 419 (1908) (“*Snow v. Lake Shore* . . . is a case where a claim was limited by a description of the device, with reference to drawings. The court, in rejecting the contention that the description of the particular device was to be taken as a mere recommendation of the patentee of the manner in which he contemplated to arrange the parts of his machine, said there was nothing in the context to indicate that the patentee contemplated any alternative for the arrangement of the parts of the device.”).

154. *Snow*, 121 U.S. at 630.

155. *Id.*

Perhaps the best-known example of narrow inventorship is the 1885 Supreme Court case concerning the *The Incandescent Lamp Patent*.<sup>156</sup> The case focused on inventors who could not generalize beyond their limited operable embodiments. In particular, the inventors employed trial-and-error screening that is, in principle, no different than techniques employed today in biotechnology.<sup>157</sup> Furthermore, the case also made clear that narrow inventorship need not prevent broad patent scope if that initially narrow invention is broadened before filing the patent.<sup>158</sup> The Court noted that, having found an operable embodiment, an inventor could earn a broader patent *if*, by understanding that one embodiment, the inventor could then generalize and provide alternatives.<sup>159</sup>

In the search for useful incandescent light bulb filaments, progress had been made as to the suitable shapes, electrical resistances, and even general construction of the filaments.<sup>160</sup> But researchers were still hunting to find the best materials from which to construct the filaments.<sup>161</sup> In their patent, the plaintiffs Sawyer and Mann disclosed that they had reduced to practice filaments made from both carbonized paper and wood carbon.<sup>162</sup> They confined their third claim to these embodiments, claiming filaments “formed of carbonized paper, substantially as described.”<sup>163</sup> Their first claim, though, was much broader, covering a filament constructed from any “carbonized fibrous or textile material.”<sup>164</sup> Commenting on these two claims, the Supreme Court noted that “[i]nstead of confining [their claims] to carbonized paper, as they might properly have done, and in fact did in their third claim, they made a broad claim for [filaments made from] every fibrous or textile material.”<sup>165</sup> The Court asked if the patentees were “entitled” to such a broad “monopoly,” to which the Court answered “[w]e think not,” and affirmed the invalidity of the asserted claims.<sup>166</sup>

Importantly, the case does not stand for the proposition that patentees can only rightfully claim the embodiments that they *actually*

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156. 159 U.S. 465 (1895), *aff'g* Consol. Elec. Light Co. v. McKeesport Light Co., 40 F. 21 (W.D. Pa. 1889).

157. *See id.* at 467.

158. Much of this discussion is adapted from Brief of Oskar Liivak as Amicus Curiae Supporting Abbott Laboratories, Centocor Ortho Biotech, Inc. v. Abbott Labs., 636 F.3d 1341 (Fed. Cir. 2011) (No. 2010-1144), 2010 WL 1808581.

159. *See id.* at 475-76.

160. ARTHUR A. BRIGHT, JR., *THE ELECTRIC-LAMP INDUSTRY: TECHNOLOGICAL CHANGE AND ECONOMIC DEVELOPMENT FROM 1800 TO 1947*, at 35-42 (1949).

161. *Incandescent Lamp*, 159 U.S. at 471.

162. *Id.* at 467.

163. *Id.* at 468.

164. *Id.*

165. *Id.* at 472.

166. *Id.*



reduce to practice. The Court made it clear that Sawyer and Mann, even with only the two embodiments that were *actually* reduced to practice, could have invented and disclosed more broadly. The Court stated, “[i]f the patentees had discovered in fibrous and textile substances a quality common to them all, or to them generally, as distinguishing them from other materials, such as minerals, etc., and such quality or characteristic adapted them peculiarly to incandescent conductors, such claim might not be too broad.”<sup>167</sup> In other words, if their knowledge of these materials allowed them to conceive of the other particular fibrous and textile materials that were suitable as filaments, then such a broad claim “would, perhaps, not [have been] extravagant.”<sup>168</sup> As discussed above in relation to high inventorship, where an inventor has broadly conceived of solutions to his or her relevant problem and then disclosed that broad conception, patent law, insofar as 35 USC § 112 ¶ 1 is concerned, allows the invention and patent scope to track that broad conception.

But where a patentee has not disclosed anything beyond the embodiments that have been *actually* reduced to practice, patent law has no choice but to limit the claims to those embodiments. As stated by the Supreme Court:

Under these circumstances, to hold that one who had discovered that a certain fibrous or textile material answered the required purpose should obtain the right to exclude everybody from the whole domain of fibrous and textile materials, and thereby shut out any further efforts to discover a better specimen of that class than the patentee had employed, would be an unwarranted extension of his monopoly, and operate rather to discourage than to promote invention.<sup>169</sup>

Just as for high inventorship, patent scope extends only as far as the disclosed invention. When no more than one or a few embodiments are disclosed, patent scope does not extend any further as well.

### *B. Modern Examples of Narrow Inventorship*

In accord with *The Incandescent Lamp Patent* case, modern patent law also allows patent claims broader than the preferred embodiments *when the specification evidences a conception and invention broader than those embodiments*. For example, in *Enzo Biochem, Inc. v. Gen-Probe Inc.*, the Federal Circuit recognized that the deposit of a nucleotide sequence could provide written description support for that sequence.<sup>170</sup> Yet the Court did not announce a brightline rule

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167. *Id.* at 472.

168. *Id.* at 476.

169. *Id.*

170. 323 F.3d 956, 966 (Fed. Cir. 2002).

that claims were necessarily limited to that deposited embodiment. In theory, a patentee could claim more broadly than the one embodiment that was actually reduced to practice and deposited. The Court, citing to the PTO's Written Description Guidelines, held that a patentee could claim more broadly "by disclosure of sufficiently detailed, relevant identifying characteristics . . . i.e., complete or partial structure, other physical and/or chemical properties, *functional characteristics when coupled with a known or disclosed correlation between function and structure*, or some combination of such characteristics."<sup>171</sup>

In other words, the description of an actual embodiment that has been reduced to practice can be part of the support for a broader genus claim when the specification also discloses additional information, like some "correlation between function and structure" of the genus,<sup>172</sup> or as put by the Supreme Court, some "quality common to" the genus.<sup>173</sup> This simply echoes the discussion of high inventorship above. To claim broadly, the inventor must both invent and disclose broadly. The PTO Guidelines cited in *Enzo* state that "[t]he 'essential goal' of the description of the invention requirement is to clearly convey the information that an applicant has invented the subject matter which is claimed."<sup>174</sup> As emphasized by Judge Newman's concurrence in *Enzo*, the disclosure requirements of § 112 "sets forth what has been invented, and sets boundaries of what can be claimed."<sup>175</sup>

### C. Patent Scope for Monoclonal Antibodies

One unresolved area where the issue of narrow inventorship *should* play, but has not yet played, a decisive role is the patenting of monoclonal antibodies.<sup>176</sup> It is one of the most important areas for new drug discoveries and advances.<sup>177</sup> The revenues associated with these new drugs are truly staggering, often reaching into the billions per year.<sup>178</sup> Antibody patents are also notable because they benefit from what has come to be known as the "antibody exception."

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171. *Id.* at 964 (quoting Guidelines for Examination of Patent Applications Under the 35 U.S.C. 112, ¶ 1, "Written Description" Requirement, 66 Fed. Reg. 1099, 1104 (Jan. 5, 2001)).

172. *Id.*

173. *Incandescent Lamp*, 159 U.S. at 472.

174. 66 Fed. Reg. 1099, 1104 (citing *In re Barker*, 559 F.2d 588, 592 n.4 (C.C.P.A. 1977)).

175. *Enzo Biochem*, 323 F.3d at 975 (Newman J., concurring) (internal quotation marks omitted).

176. See Paula K. Davis & Steven P. Caltrider, *Timing (of Invention) Is Everything: The Essential Role of the Written Description Requirement in Determining Conception*, 15 FED. CIR. B.J. 39, 58-65 (2005).

177. See Brief for Eli Lilly & Co. as Amicus Curiae Supporting Defendant-Appellant at 2, *Centocor Ortho Biotech, Inc. v. Abbott Labs.*, 636 F.3d 1341 (Fed. Cir. 2011) (No. 2010-1144), 2010 WL 1808582.

178. See, e.g., *Humira Sales Data*, DRUGS.COM, <http://www.drugs.com/stats/humira> (last visited Jan. 17, 2013).

The PTO's Written Description Guidelines describe one example in which the disclosure of one monoclonal antibody (i.e. one embodiment), along with structural information about the *antigen*, can provide support for any antibody that binds to that antigen.<sup>179</sup> Cases like *Noelle v. Lederman* have favorably cited these guidelines, though they have not relied upon them for their holdings.<sup>180</sup> The trouble is that those PTO guidelines are in tension, if not in complete conflict, with the basic notions of the invention outlined here.<sup>181</sup>

Disclosure of a well-characterized antigen alone would not provide support for any antibody that binds to that antigen. And disclosure of one actual antibody provides § 112 support only for that antibody—not the entire genus of antibodies that binds to the antigen. The problem is, as put by Eli Lilly and Company in their amicus brief in *Centocor v. Abbott*, “[e]ven with today’s most advanced scientific tools, it is impossible to predict the actual structure . . . of a not-yet-known antibody based on the structure of an antigen or even the structure of another antibody that binds that same antigen.”<sup>182</sup> Given the three-dimensional structure of an antigen, we cannot today conceive (without actually going into the lab and making one) an antibody that will bind to that antigen.<sup>183</sup> Furthermore, even once we make one antibody that does bind to an antigen, that alone does not allow for the conception of any other antibodies (much less every antibody) that will also bind to that antigen.<sup>184</sup>

As the Federal Circuit determined, Centocor’s “application only provides amino acid sequence information . . . for a single mouse variable region.”<sup>185</sup> It was the one variable region deposited. Yet claims two and three covered all variable regions that bind and neutralize TNF $\alpha$  in a similar location as the deposited antibody.<sup>186</sup> There is nothing in the specification that evidences conception of any other variable regions beyond the one deposited variable region.<sup>187</sup> That disparity between the solutions disclosed versus the solutions

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179. See U.S. PATENT & TRADEMARK OFFICE, WRITTEN DESCRIPTION TRAINING MATERIALS, REVISION 1, at 45-46 (March 25, 2008).

180. 355 F.3d 1343 (Fed. Cir. 2004).

181. *Ariad Pharms., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1353-55 (Fed. Cir. 2010) (en banc).

182. See Corrected Brief of Eli Lilly & Co. as Amicus Curiae Supporting Abbott Laboratories at 6, *Centocor Ortho Biotech, Inc. v. Abbott Labs.*, 636 F.3d 1341 (Fed. Cir. 2011) (No. 2010-1144), 2010 WL 1808582 at \*6.

183. See *Davis & Caltrider*, *supra* note 176, at 59-60.

184. See *id.*

185. *Centocor*, 636 F.3d 1341, 1349 (Fed. Cir. 2011).

186. *Id.* at 1346-47.

187. *Id.* at 1350-51.

claimed makes the issue of antibody patenting the modern version of the overreaching patentees in *The Incandescent Lamp Patent* case.<sup>188</sup>

Yet *Centocor* did not explicitly overrule the antibody exception. We still do not have clear guidance that even this immensely important field must abide by the rules set for the rest of patent law—patent scope cannot extend beyond the disclosed invention. If a solution to a technical problem is found through trial and error (even sophisticated, elegant trial and error such as for antibodies) without further discovering how to extrapolate to other solutions, claims cannot exceed that one particular solution.<sup>189</sup> Currently antibody patents have scope that far exceeds the inventions disclosed in their patents. It is an area where these arguments about narrow inventorship should have an important impact.

#### IV. THE INVENTION AND AFTER-ARISING TECHNOLOGY

This Part applies this spectrum of high and low inventorship to explain the reach of patent scope into after-arising technology. It is an area that is still controversial and unsettled in the courts and in patent scholarship. As explained by Robin Feldman:

[C]ases concerning how far a biotechnology inventor can reach toward future inventions stand in contradiction to each other. Some opinions conclude broadly that the definition of an invention includes all embodiments, even those that could not have existed at the time of the invention. Other opinions use claim construction doctrines to limit a patent holder's reach only to embodiments known at the time of the invention. Still others use a different set of doctrines to conclude that a patent holder's reach *sometimes* includes things that were unknown at the time of the invention, but not always. These opinions, pulling in different directions, make it difficult to predict how far an inventor can reach toward later inventions.<sup>190</sup>

Nonetheless, though the doctrine is confusing, there is a strong sense among many that “patent claims . . . should grow over time to encompass improvements”<sup>191</sup> even, and perhaps especially, improvements that use after-arising technology *in at least some cases*. If patents are to reach such technology, then many find it impossible to limit patent scope “to the set of things that a patentee makes available to the public” in their patent specification.<sup>192</sup> This particular area demonstrates in a particularly metaphysical way the difficult tension

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188. See 159 U.S. 465 (1895), *affg* Consol. Elec. Light Co. v. McKeesport Light Co., 40 F. 21 (W.D. Pa. 1889).

189. See *id.* at 472.

190. Robin Feldman, *Rethinking Rights in Biospace*, 79 S. CAL. L. REV. 1, 4 (2006).

191. Collins, *supra* note 58, at 1233.

192. *Id.*; see also Chiang, *supra* note 38, at 1237.

between clear, predictable notice of patent boundaries and adequate scope of those boundaries.

Though there is some debate about this issue,<sup>193</sup> most agree that patents should cover after-arising technology to some degree. After all, if they cannot, then many worry that most patents would quickly become worthless, as copyists could ride the coattails of an initial patent while evading its exclusive reach due to some technological change that had been unavailable at the time the initial patent was filed.<sup>194</sup>

For example, consider the famous Wright Flyer invented and patented by the Wright brothers. It was an airplane built with a mostly wooden frame with canvas stretched over it. Suppose that, after filing their patent, a competitor learns that material science has advanced and that a new covering material (that could not have been explicitly disclosed by the Wright brothers) has been invented and is available. The competitor buys the new material and, following the Wright patent, builds the Wright Flyer with this new, after-arising covering rather than the older canvas disclosed and used by the Wrights. Should the Wright brothers patent extend to this new airplane or not?<sup>195</sup>

Many would agree that the Wright patent should extend to the after-arising variant, and indeed as a descriptive matter, patents have always covered after-arising technology to some degree. Yet once that door is opened (as I think it should and must), patent law is confronted with a number of challenges. Patent law must answer when and to what extent such extensions into after-arising technology should be made. Patent law must create a coherent, consistent framework by which inventors, patent attorneys, and judges can understand the proper limits of patents for this critically important area.

Developing this needed framework is challenging. First, it is challenging (perhaps inherently so) because of the nature of after-arising technology. As argued above, patent law is based on the idea that the patent rights extend only to that which the inventor both invented and disclosed. Yet how could an inventor disclose some technology that by definition arises after the patent has been filed?<sup>196</sup> How could

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193. Joshua D. Sarnoff, *Abolishing the Doctrine of Equivalents and Claiming the Future After Festo*, 19 BERKELEY TECH. L.J. 1157, 1205-08 (2004) (arguing against patent scope reaching into after-arising technology).

194. See Merges & Nelson, *supra* note 36, at 845.

195. See Collins, *supra* note 58, at 1233 (describing these specific component improvement scenarios as easy cases).

196. See Kevin Emerson Collins, *The Reach of Literal Claim Scope into After-Arising Technology: On Thing Construction and the Meaning of Meaning*, 41 CONN. L. REV. 493, 496 (2008) ("In gross, the argument is that literal claims 'cannot capture the later-developed technologies because to do so would require the claims to be interpreted as they are understood at some time after the filing date.' In part, advocates of this rule emphasize the better public notice that results from claims whose meanings are fixed at an early date. In part, advocates of the fixation theory also support their position by arguing that control

the Wright brothers invent and disclose an airplane covered by a new fabric that did not even exist when they wrote their patent? As discussed next, all current attempts to create a coherent and consistent treatment of after-arising technology are forced to confront this issue, and the ensuing contortions required have been unsatisfying in one way or another. Second, it is challenging because the actual cases dealing with after-arising technology are not all uniform. Some cases allow the patent to cover after-arising technology while others do not. A coherent theory of after-arising technology needs to explain the outcomes of these cases.

#### *A. Attempts at a Coherent Framework*

Patent scholarship has tried to address these cases and the whole topic of after-arising technology. Rob Merges put forth one of the earliest explanations. He aimed to resolve this confusion, which he termed the temporal paradox, by showing that the *timing* of the disclosure requirement and infringement standard differed.<sup>197</sup> Merges noted that enablement was judged at the time of filing, while infringement was judged later at the time of infringement.<sup>198</sup> According to Merges's view, the Wright brothers could disclose their airplane with their canvas covering and they could claim an airplane with a covering. Such a claim would satisfy the enablement requirement as they have enabled a person of skill to make an airplane covering *as that term was understood at the time of filing*. At some later date, when a competitor makes the airplane variant with the after-arising covering, that claim would still be valid, but would—for infringement purposes—be construed as the term was understood *at the time of infringement*. As the new material would now qualify as a covering, the new airplane variant would infringe the Wright brothers' patent. Because of this temporal disparity, a valid claim is able to cover embodiments that were not explicitly disclosed in the patent application.

As a descriptive matter, some cases do fit this mold. As described in more detail below, the court in *Laser Alignment v. Woodruff* allowed the scope of "a collimated beam of light" to expand to include a laser despite the fact that lasers had not been invented until *after* the patent at issue had been filed.<sup>199</sup> Yet other cases do not fit this mold. In *Schering v. Amgen*, the court limited the meaning of a claim term

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over [after-arising technology] is normatively undesirable because it is tantamount to control over something that the patent applicant did not invent.").

197. Robert P. Merges, *Rent Control in the Patent District: Observations on the Grady-Alexander Thesis*, 78 VA. L. REV. 359, 379 n.73 (1992).

198. *Id.*

199. *Laser Alignment, Inc. v. Woodruff & Sons, Inc.*, 491 F.2d 866, 868-69 (7th Cir. 1974).

to the meaning at the time of filing.<sup>200</sup> The term was not allowed to expand to capture after-arising technology.<sup>201</sup>

In addition to this descriptive incompleteness, there are other problems with the temporal disparity explanation. First, the existence of the temporal disparity requires construing patent claims differently at different times. As argued by Mark Lemley, this inconsistency, though allowing for patents that cover after-arising technology, breaks a cardinal rule of fairness in patent law: claims are interpreted alike for both validity and infringement purposes.<sup>202</sup> A patentee should not be able to argue that claims mean one narrow thing to get them past the validity requirements, while then arguing that the claims mean something much broader in order to catch infringers.<sup>203</sup>

Second, though the theory explains some of the cases, its mechanism of reaching after-arising technology appears somewhat arbitrary in that it depends a great deal on the growth in scope of claim terms alone (which are almost always drafted by an attorney), rather than any fact derived from the underlying invention. For example, had the Wright brothers hypothetically claimed their airplane as “covered by cotton canvas” rather than the more generic “having a covering,” they would likely have been out of luck. The term “covering” could fortuitously grow over time while the term “cotton canvas covering” likely could not grow as much. This puts undue emphasis on the particular claim terms used as opposed to the invention disclosed in the patent.

In light of these problems, Mark Lemley argued that claim terms should be construed at one fixed point in time, and he argued that the time of filing should be used.<sup>204</sup> For him, this limitation provides better public notice, but it prevents the temporal disparity from providing *literal* claim scope for after-arising technology.<sup>205</sup> He adds that “[t]his does not mean, however, that the patents themselves cannot cover later-developed technologies. Patentees can use the doc-

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200. See *Schering Corp. v. Amgen Inc.*, 222 F.3d 1347, 1353-54 (Fed. Cir. 2000).

201. See *id.*

202. Mark A. Lemley, *The Changing Meaning of Patent Claim Terms*, 104 MICH. L. REV. 101, 103 (2005) (stating that the “fundamental principle of patent law [is] that patent claims must be construed as an integrated whole. A patent claim may not be treated ‘like a nose of wax which may be turned and twisted in any direction, by merely referring to the specification, so as to make it include something more than, or something different from, what its words express.’ In particular, patentees (or accused infringers, for that matter) are not permitted to argue that a patent claim means one thing when it comes to validity and something else entirely when it comes to infringement.” (quoting *White v. Dunbar*, 119 U.S. 47, 51 (1886))).

203. *Id.*

204. *Id.* at 122.

205. *Id.* at 103 (“Cases like *Hogan* and *Chiron* that expand the literal meaning of those claims, creating a ‘temporal disparity’ between meaning for validity purposes and for infringement purposes, will have to be rejected.”).

trine of equivalents to reach such technologies.”<sup>206</sup> Indeed, he argues that the modern doctrine of equivalents despite its many limitations can (and is especially designed to fill that role. Others have similarly argued for using the doctrine of equivalents in reaching after-arising technology.<sup>207</sup> But the reliance on the doctrine of equivalents cannot be a fully satisfactory answer. As it is currently understood it is notoriously hard to predict and administer. As a result, pushing off these hard questions into the doctrine of equivalents simply hides the underlying lack of predictability. If the doctrine were more predictable, then perhaps it could become a reliable tool for reaching after-arising technology.

Apart from the doctrine of equivalents, recently Kevin Collins proposed an innovative alternative mechanism that in many ways combines both of these approaches.<sup>208</sup> He focused on a mechanism by which literal claim scope can expand to capture after-arising technology during claim *construction* while claim *interpretation* would remain firmly fixed at the time of filing.<sup>209</sup> The key to his proposal is that claim language can be viewed as describing a set definition, and the words that define the set are interpreted as of the time of filing. Yet the members of that set (meaning embodiments that qualify for membership) can grow over time.<sup>210</sup> Collins shows how these linguistic tools can allow interpretation to occur as of the time of filing while the claims can be construed at the time of infringement.<sup>211</sup>

Collins’s approach is interesting because it meshes nicely with the above discussion of broad inventorship and generalized embodiments. By disclosing essential conditions that need to be satisfied, for example by stating that the material is immaterial, the inventor can disclose embodiments that cannot yet be built. In other words,

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206. *Id.*

207. See Cotropia, *supra* note 39, at 1863; Timothy R. Holbrook, *Equivalency and Patent Law’s Possession Paradox*, 23 HARV. J.L. & TECH. 1 (2009).

208. Collins, *supra* note 196, at 499 (describing that patent law can “have [its] cake and eat it, too. This both-and result is what this Article calls the *fixation-growth paradox* of literal claim scope: literal claim scope can remain fixed at the time of filing, yet it can (and routinely does) grow to encompass [after-arising technology] nonetheless.”).

209. Collins does not himself differentiate between claim interpretation and claim construction, yet I think the difference between interpretation and construction does capture the sought-after distinction. It is notable that today patent boundaries are notoriously hard to pin down and I think this has been caused in part by a failure to consider the differing roles for claim interpretation and construction.

210. See Collins, *supra* note 58, at 1308-09. Holbrook makes a similar argument using the doctrine of equivalents where the set of embodiments that are equivalent grow as the level of knowledge grows over time. See Holbrook, *supra* note 207, at 44-45.

211. See *Bd. Of Trs. of Leland Stanford Jr. Univ. v. Roche Molecular Sys., Inc.*, 528 F. Supp. 2d 967, 980, 982 (N.D. Cal. 2007) (treating the claim language in this way: “The term in question may be a category, the contents of which expand over time. . . . Here, there is no evidence that the patentee intended to limit the patent ‘antiretroviral agents’ to known and available technologies, nor is there evidence that the categorical term, antiretroviral agents, was ever used to refer only to agents that inhibit reverse transcription.”).



though those after-arising embodiments cannot be built yet, the instructions for their construction are already waiting in the patent disclosure for use later by future persons of skill. They form what I call a trans-technological disclosure or a functional disclosure.<sup>212</sup>

The reach of a patent into after-arising technology is simply a relation to its high or low inventorship. In cases of high inventorship, where some feature of the disclosed embodiments is highly generalized, after-arising technology can embody the invention. In contrast, for low inventorship the invention does not extend beyond the specific embodiments already described. In those cases, patent scope should not extend into after-arising technology.

Two cases, *Schering v. Amgen*<sup>213</sup> and *Laser Alignment v. Woodruff*,<sup>214</sup> have often been used to explore patent scope as it relates to after-arising technology. In *Schering*, the courts refused to interpret the claim term IFN- $\alpha$  broadly, thus preventing the claim and the patent from encompassing after-arising variants of the IFN- $\alpha$  protein.<sup>215</sup> In contrast, in *Laser Alignment*, the court interpreted the claim term "collimated beam of light" broadly, allowing the claim and the patent to encompass the use of lasers even though lasers were not invented until after the patent had been filed.<sup>216</sup>

These seemingly contradictory cases can be reconciled when viewed from the perspective of the disclosed invention. In short, the inventor in *Schering* disclosed a narrow invention that did not extend beyond the one explicitly disclosed variant of IFN- $\alpha$ .<sup>217</sup> In contrast, the inventor in *Laser Alignment* disclosed a more generalized method where the exact source of the collimated beam of light (whether a focused beam from a traditional lamp or a laser) was not material.<sup>218</sup> One case was a narrow invention with no reach into after-arising technology, while the other was broader allowing some reach into after-arising technology along the dimension of the light source.

In *Schering*, the patent at issue related to "recombinant DNA molecules encoding specific types of human interferon."<sup>219</sup> In particular, the patent as a whole and the claims referred to "DNA sequences which code on expression for a polypeptide of the IFN- $\alpha$  type [of interferon]."<sup>220</sup> Interferon, we now know, is a class of proteins that play an

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212. See *supra* notes 22-26 and accompanying text.

213. *Schering Corp. v. Amgen Inc.*, 222 F.3d 1347 (Fed. Cir. 2000).

214. *Laser Alignment, Inc. v. Woodruff & Sons, Inc.*, 491 F.2d 866 (7th Cir. 1974).

215. See *Schering Corp.*, 222 F.3d at 1352-55.

216. See *Laser Alignment*, 491 F.2d at 873-74.

217. See *Schering Corp.*, 222 F.3d at 1353.

218. See *Laser Alignment*, 491 F.2d at 868-69.

219. *Schering Corp.*, 222 F.3d at 1349.

220. *Id.* at 1350.

important role in our bodies' own antiviral defenses.<sup>221</sup> At the time the inventor in *Schering* filed his patent, much of this was not yet known. But soon, "[t]he scientific meaning of 'IFN- $\alpha$ ' evolved with new discoveries. Specifically, the scientific community learned that leukocytes produce more than a single interferon polypeptide."<sup>222</sup>

One of the main issues in the case then became whether the claim term IFN- $\alpha$  should be interpreted narrowly to include only the protein explicitly disclosed by the inventor, or whether it should be interpreted broadly according to its more modern meaning. The correct answer is to first understand the disclosed invention, determining whether it is narrow or broad, and then to attempt to interpret the claim term as consistently as possible with the disclosed invention.<sup>223</sup> In this case, the patent itself made clear that the successful embodiment was one that was found by a trial-and-error screening process.<sup>224</sup> And without any significant ability to generalize other solutions, the court concluded that "[e]ven a cursory review of the claims reveals that they recite the specific recombinant DNA inserts isolated by Dr. Weissmann, and their use."<sup>225</sup> Ultimately, the court "interpret[ed] the claim term 'IFN- $\alpha$ ' in light of the patent's written description. The written description clarifies that Dr. Weissmann made no attempt to broaden his invention to cover polypeptides not discovered at the time of his patent application."<sup>226</sup> The court looked to the patent and found a narrow invention without any alternatives disclosed, and the claims were rightfully interpreted narrowly. The court concluded that "[t]o grant broader coverage would reward Dr. Weissmann for inventions he did not make."<sup>227</sup>

In contrast in *Laser Alignment*, the court interpreted a claim term broadly allowing it to encompass after-arising technology.<sup>228</sup> As relayed by the court, the patent disclosed "a method and means for laying [a] pipeline on a selected grade line by resort to establishing a light beam line of reference."<sup>229</sup> The patent described a method by which a "collimated beam of light" is used as a reference line that allows pipe to be laid along a prescribed gradient.<sup>230</sup> The patent itself disclosed that:

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221. THOMAS J. KINDT, ET. AL., *KUBY IMMUNOLOGY* 9 (6th ed. 2007) ("Interferon comprises a group of proteins produced by virus-infected cells. Among the many functions of the interferons is the ability to bind to nearby cells and induce a generalized antiviral state.").

222. *Schering Corp.*, 222 F.3d at 1353.

223. See Liivak, *supra* note 9, at 36.

224. U.S. Patent No. 4,530,901 col.10 ll.5-6 (filed Feb. 4, 1980) ("[T]he isolation of an active clone is a 'needle in a haystack' screening process.").

225. *Schering Corp.*, 222 F.3d at 1351.

226. *Id.* at 1352.

227. *Id.* at 1354.

228. *Laser Alignment, Inc. v. Woodruff & Sons, Inc.*, 491 F.2d 866 (7th Cir. 1974).

229. *Id.* at 868.

230. *Id.* at 868-69.

The projector is provided with the well-known pin hole aperture and condensing lens (not shown) for projecting a beam of light having parallel rays. The beam of light is pencil-like in diameter and the light source is of a high candlepower adequate to project the beam a distance of up to 400 feet.<sup>231</sup>

And in describing the patented method, the claims require the step of “projecting a collimated narrow beam of light from said source position along the selected axis.”<sup>232</sup>

The defendant was using a near-identical method, but used a laser rather than the lamp and lens explicitly disclosed in the patent. The district court held that the “defendants had not infringed” because “[t]he use of a beam generated by a laser in a method of laying sewer pipe cannot infringe a claim directed to use of a collimated beam of light contained in a patent whose application was filed before the invention of the laser.”<sup>233</sup> The appellate court reversed, holding that:

A fair reading of the Trice claims indicates that Trice's invention consisted of a method of, not an apparatus for, laying underground pipe by projecting any collimated narrow beam of light through pipes as a reference line, the intercept of which with a translucent target provides a guide for the laying of such pipes. We find no real dispute in the record of the fact that the laser beam used by the defendants was a collimated narrow beam of light.<sup>234</sup>

By using more generic language like “collimated beam of light” and by explicitly describing how the technology of the time could be adapted to produce a source of collimated light,<sup>235</sup> the inventor disclosed important functions that the light source should satisfy. In those few words, the inventor disclosed an invention that was broader than the exact method and particular equipment available at the time the patent was filed. As “to the collimated beam of light,” the invention disclosed in the patent in *Laser Alignment* was broad enough to encompass a method that employed a laser.

In short, the current, seemingly confusing state of after-arising patent scope can be explained and rationalized as simply an attempt to allow the patentee to receive the full scope of their disclosed invention. For broad inventorship this means, at times, allowing claim scope to grow to include some after-arising technology. For narrow inventorship though, patent law should generally avoid allowing patent scope from reaching after-arising embodiments. In either case, patent law is just trying to protect the invention disclosed in the patent.

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231. U.S. Patent No. 3,116,557 col.4 ll.44-49 (filed Dec. 4, 1957).

232. *Id.* at col.6 ll.15-19.

233. *Laser Alignment*, 491 F.2d at 871.

234. *Id.* at 872.

235. '557 Patent col.6 ll.15-19 (describing using a condensing lens (not shown) for projecting a beam of light having parallel rays).

## V. NORMATIVE PATENT POLICY AND LIMITING SCOPE TO THE INVENTION

Arguing that the invention, and thereby patent scope, is limited to the set of embodiments disclosed in the patent raises important questions. Can that limit really be defended as a policy matter? The conventional wisdom surely seems to suggest that patent scope cannot be so narrowly limited. Yet proving such an assertion is often much harder.<sup>236</sup>

But before considering the normative case for the invention as a limit for patent scope, it is worth emphasizing the conclusions of the past few Parts. Those Parts aimed to show that the invention was a more sophisticated and better-developed concept than is generally thought. Importantly, the invention was shown to be able to explain much of the variations in patent scope including variations in the reach of patent scope into after-arising technology.

And though many worry that the invention is too narrow of a concept, the previous Parts showed that the invention could, in many cases, be broad. In fact, for a point of comparison, Ed Kitch's prospect theory is often cited as the theory that provides normative support for broad patents. And yet in his foundational article Kitch laid out his understanding of the "hornbook rule" that an "inventor may not claim more than he has invented."<sup>237</sup> He noted that a patent claim could extend to:

[A]n abstraction and generalization of an indefinitely large number of concrete, physical objects. Thus to illustrate from a nineteenth-century case, an inventor could claim a process of separating fats into glycerine and stearic, margaric and oleic acids through the use of heat, pressure, and water at any temperature and in any apparatus that would work.<sup>238</sup>

This description does not sound that far off from the description of the disclosed invention provided here.

In addition to the descriptive arguments, this Part will proceed to provide the more difficult normative arguments that support limiting patent scope to the disclosed invention. To make that case this Part focuses on a comparative analysis: Should the patent system limit patent scope to the disclosed invention, or should it extend patent scope further to cover embodiments not invented or disclosed by the patentee? As will be shown below, there are strong arguments that a system that extends protection beyond the invention will be costlier

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236. See Oskar Liivak, *Maturing Patent Theory from Industrial Policy to Intellectual Property*, 86 TUL. L. REV. 1163 (2012) (arguing that the current incentive narrative inherently makes definitive policy planning impossible).

237. Kitch, *supra* note 42, at 268.

238. *Id.*

and there appear to be no additional benefits from that protection that could offset those additional costs. As a result, in addition to the doctrinal arguments made above, there is strong normative case for limiting patent scope to the disclosed invention.

*A. Limiting to the Invention: Reducing Costs Through  
Boundary Clarity*

In their book, *Patent Failure*, Michael Meurer and James Bessen develop an empirical assessment of the patent system.<sup>239</sup> Though a societal cost-benefit analysis of the patent system as a whole has been notoriously elusive, Meurer and Bessen set their sights on a narrower, more manageable cost-benefit analysis. They examine the costs and benefits associated with the one group that surely benefits from the current patent system: inventors.<sup>240</sup> As the presumptive direct beneficiaries of the lucrative patent grant, inventors should surely benefit from the patent system. Yet in a startling result, Meurer and Bessen show that for the average patent holder the costs of the current system outweigh the benefits.<sup>241</sup> The patent system is failing even the one group the system ostensibly aims to subsidize.

In diagnosing the reasons for this, Meurer and Bessen lay blame on the patent system's inability to provide clear public notice of patent boundaries. They argue that the doctrines that determine patent scope are "unpredictable."<sup>242</sup> Claims and patent scope have become what the Supreme Court long ago feared: "a nose of wax which may be turned and twisted in any direction."<sup>243</sup> Meurer and Bessen note that today "[t]here is . . . no reliable way of determining patent boundaries short of litigation."<sup>244</sup> Not only are the boundaries unclear and "fuzzy,"<sup>245</sup> but also many areas of technology are burdened with numerous broad and—more importantly—overlapping patents. Every one of these overlapping patents arms each patent holder with the right to hold-up the underlying productive activity. With patent trials regularly costing millions of dollars in legal fees, even inventors appear to be choking on the uncertainty and excess of the current patent system. They conclude that, "the main goal of [patent] reform should be to improve patent notice."<sup>246</sup>

As I have argued here and elsewhere, confining a patent's exclusive rights to the disclosed invention (i.e. the set of embodiments dis-

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239. BESSEN & MEURER, *supra* note 2.

240. *Id.* at 3-4.

241. *See id.* at 14-15.

242. *Id.* at 10.

243. *White v. Dunbar*, 119 U.S. 47, 51 (1886).

244. BESSEN & MEURER, *supra* note 2, at 10.

245. *Id.*

246. *Id.* at 236.

closed in the patent) will help the efficiency and clarity of patent law's public notice function.<sup>247</sup> The rule helps provide more predictable and stable claim interpretation as claims would be interpreted to circumscribe only embodiments disclosed. As boundary vagueness is one of the major contributors to patent law's current problems, this improved boundary delineation is an important advance.

### *B. No Certain Benefits Beyond the Invention*

Concluding, as the previous Part did, that there are additional costs to extending patent protection beyond the invention does not end the discussion. If that broader patent system could show that it also provides additional offsetting benefits above and beyond its additional costs, then such a broad theory could still be supported on policy grounds.<sup>248</sup> Indeed many worry that a narrower system just cannot provide the same benefits of the broader system.<sup>249</sup>

This Part goes looking for those benefits and cannot find them. As the patent system is generally seen as a system for providing incentives to inventors, this comparative benefit analysis first considers the aggregate incentives provided to inventors as whole. When looking at the collective group of inventors, this Part finds that there is no benefit from the broader system. Different specific inventors will benefit from that broad protection (namely those who are lucky enough to get those broad claims), but in aggregate the class of inventors is no better off with broader protection.

In other words, patent protection beyond the actual invention is just a wealth transfer among inventors. To see this, consider the factors needed to realize revenue from a patent whose scope exceeds the patentee's actual invention. In that case, a revenue stream only becomes available when someone else invents one of the embodiments claimed but not invented by the earlier patentee. As that second inventor begins to capitalize on their invention, the broad patent allows the first inventor to receive some fraction of that revenue stream. That revenue stream diverted to the first inventor is coming from the second inventor. This broader patent system only manages to transfer wealth between inventors. On the whole, inventors as a group are no better off with the broader rule.

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247. See Liivak, *supra* note 9; see also Chiang, *supra* note 38; Cotropia, *supra* note 39 (agreeing that benefits could accrue to using this notion of the invention but ultimately abandoning it for what he perceives to be both descriptive and normative ill fit).

248. Even if such a system could make normative claims, it would require quite a strained reading of the statute, and would require ignoring a multitude of Supreme Court precedents.

249. See *supra* notes 31-40 and accompanying text; see also Oskar Liivak, *Maintaining Competition in Copying: Narrowing the Scope of Gene Patents*, 41 U.C. DAVIS L. REV. 201-03 (2008).

From that aggregate analysis, there are sure to be higher costs from protection beyond the invention, and yet there are not any obvious aggregate benefits for inventors. Yet that still does not complete the analysis of comparative benefits. It is possible that the distribution of incentives between earlier and later inventors matters. In other words, perhaps initial inventors need larger incentives beyond their actual invention while later inventors need fewer incentives and should be obligated to subsidize the initial inventor. I now look to that possibility and find little support.

### *C. Do Initial Inventors Need More?*

One possible rationale for extending patent protection beyond the invention (despite its aggregate inability to generate more incentives for inventors) depends on a free riding argument. Perhaps the second inventor copied and improved on the initial invention. But for that initial invention we might not have the second invention at all. This could provide the basis for a narrative where initial inventors require more protection. Yet recent research has shown that only a small fraction of patent cases (about 10 percent) involve any allegation that the defendant actually copied from the inventor.<sup>250</sup> Second-arriving inventors rarely copy from earlier inventors.<sup>251</sup> In addition, if there were copying of the technological embodiments disclosed in the patent, then protection limited to those embodiments would be enough to police that copying.

Relatedly, broad patent protection has been rationalized on the reasonable attempt to avoid duplication of research and development costs. To the extent we worry about one inventor redundantly expending resources inventing something already invented by another, we cannot use that worry to justify patent scope beyond the invention. Later inventors, inventing in the space beyond the invention of the first inventor, are certainly not inefficiently reinventing the wheel. They are by definition inventing something that the initial inventor did not.

In short, though there are some worries about narrowing patent scope, there are no verifiable benefits from extending patent scope beyond the invention. Yet there certainly are costs. Further recalling the fairly certain benefits of allowing claim scope to be drawn with more clarity and predictability, the normative arguments for extending patent protection beyond the invention are unpersuasive.

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250. Christopher A. Cotropia & Mark A. Lemley, *Copying in Patent Law*, 87 N.C. L. REV. 1421, 1443 (2009).

251. *See id.* at 1458-61.

*D. Beyond the Incentive Narrative*

The above normative arguments are based within the framework of the current dominant incentive based narrative where the scope of exclusion determines in large part the incentives doled out by the patent system. In other work I have strongly criticized the intractability and inherent animosity generated by that view. And indeed because of that intractability, it is hard, if not impossible, to conclusively prove that exclusion over the “patented invention” will provide incentives that delivers the optimal amount of incentive activity. As discussed above, the best that can be done is a comparative analysis. In recent work I have suggested abandoning the incentive narrative and instead consider the patent system as backing a market in inventions;<sup>252</sup> an inherent feature of that narrative is exclusion that need not extend beyond the patented invention. In short, in that narrative patent scope need not be justified as the optimal balance of costs and benefits from exclusion.<sup>253</sup>

## VI. CONCLUSION

The invention is a critically important concept for patent law generally and especially for patent scope. As shown above, the historic notions of the invention, and in particular its interaction with the principle of the invention, are up to this challenge. It can provide a conceptual framework for drawing predictable patent boundaries while still granting descriptively accurate patent scope. By thinking of inventions as existing along a continuum between broad and narrow inventorship, determined by the number of embodiments disclosed, the invention can explain the large variation in patent scope decisions. It can provide objective evidence for patent scope while still allowing patent scope to encompass after-arising technology. The invention can provide much needed clarity and predictability to patent scope determinations.

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252. See Oskar Liivak, *Establishing an Island of Patent Sanity*, BROOK. L. REV. (forthcoming 2013).

253. See *id.*



